

BOBBY JINDAL  
GOVERNOR



HAROLD LEGGETT, PH.D.  
SECRETARY

**State of Louisiana**  
DEPARTMENT OF ENVIRONMENTAL QUALITY  
ENVIRONMENTAL SERVICES

Certified Mail No.

Agency Interest (AI) No. 157847  
Activity No. PER20080002

Mr. Joe Rutkowski  
Vice President  
1915 Rexford Rd  
Charlotte, NC 28211

RE: Prevention of Significant Deterioration (PSD) Permit, PSD-LA-740  
Consolidated Environmental Management Inc - Nucor Steel Louisiana  
Convent, St. James Parish, Louisiana

Dear Mr. Rutkowski:

Enclosed is your permit, PSD-LA-740. Construction of the proposed project is not allowed until such time as the corresponding Part 70 Operating Permit is issued.

Should you have any questions, contact Kermit Wittenburg of the Air Permits Division at (225) 219-3100.

Sincerely,

Cheryl Sonnier Nolan  
Assistant Secretary

\_\_\_\_\_  
Date

CSN:kcw

c: US EPA Region VI

**Agency Interest No. 157847**

**PSD-LA-740**

**AUTHORIZATION TO CONSTRUCT AND OPERATE A NEW FACILITY  
PURSUANT TO THE PREVENTION OF SIGNIFICANT DETERIORATION  
REGULATIONS IN LOUISIANA ENVIRONMENTAL REGULATORY CODE,  
LAC 33:III.509**

In accordance with the provisions of the Louisiana Environmental Regulatory Code, LAC 33:III.509,

Consolidated Environmental Management Inc  
1915 Rexford Rd  
Charlotte, NC 28211

is authorized to construct the facility at Nucor Steel Louisiana near

From I-10 & Hwy 22 go west on Hwy 22 to Hwy 70  
Go west 4.2 Mi on Hwy 70 to Hwy 3125  
Go south 2 Mi to Main Gate  
Convent, LA 70723

subject to the emissions limitations, monitoring requirements, and other conditions set forth hereinafter.

This permit and authorization to construct shall expire at midnight on \_\_\_\_\_, 2010, unless physical on site construction has begun by such date, or binding agreements or contractual obligations to undertake a program of construction of the source are entered into by such date.

Signed this \_\_\_\_\_ day of \_\_\_\_\_, 2008.

Cheryl Sonnier Nolan  
Assistant Secretary  
Office of Environmental Services  
Louisiana Department of Environmental Quality

## BRIEFING SHEET

**Consolidated Environmental Management Inc - Nucor Steel Louisiana**

**Agency Interest No.: 157847**

**Consolidated Environmental Management Inc**

**Convent, St. James Parish, Louisiana**

**PSD-LA-740**

### PURPOSE

Consolidated Environmental Management Inc., a subsidiary of Nucor proposes to construct and operate a 6.60 million ton per year Pig Iron production facility on approximately 4,060+ acres of undeveloped land on the Mississippi River at – about mile marker +163 just upstream of Romeville.

### RECOMMENDATION

Approval of the proposed construction and issuance of a permit.

### REVIEWING AGENCY

Louisiana Department of Environmental Quality, Office of Environmental Services, Air Permits Division

### PROJECT DESCRIPTION

The Nucor Steel Louisiana facility will use the blast furnace process to produce high quality pig iron. Nucor plans for the mill to reach an anticipated peak annual production rate of over six million metric tonnes of iron per year. The basic raw materials for the pig iron production process are iron ore, in lump or pellet form; coal; sinter; and flux, which may be limestone, dolomite, or slag. The facility will process the coal into metallurgical-grade coke for use in the blast furnaces, at dedicated coke ovens on the site. The blast furnaces themselves are closed units with virtually no atmospheric emissions. The coke ovens follow the heat recovery design. A sinter plant will also be constructed at the site to recycle fine materials and dusts for increased raw material efficiency. By recovering heat from the coking process and combusting blast furnace gas in multiple boilers, the mill will produce enough electricity to completely provide for facility usage, and may also provide some electrical export to the public utility grid. Estimated emissions, in tons per year, are as follows:

<u>Pollutant</u>	<u>Emissions</u>	<u>PSD de minimis</u>	<u>Review required?</u>
PM	3,012.55	25	Yes
PM <sub>10</sub>	1,627.05	15	Yes
SO <sub>2</sub>	5,009.74	40	Yes
NO <sub>x</sub>	4,049.88	40	Yes
CO	29,406.15	100	Yes
VOC	403.14	40	Yes
Lead	0.375	0.6	No

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**PSD-LA-740**

### TYPE OF REVIEW

Particulate matter (PM/PM<sub>10</sub>), sulfur dioxide (SO<sub>2</sub>), nitrogen oxide (NO<sub>x</sub>), carbon monoxide (CO), and volatile organic compound (VOC) emissions from the proposed facility will be above PSD significance levels. Therefore, the requested permit was reviewed in accordance with PSD regulations for PM/PM<sub>10</sub>, SO<sub>2</sub>, NO<sub>x</sub>, CO, and VOC emissions. Emissions of LAC 33:III.Chapter 51-regulated toxic air pollutants (TAP) have been reviewed pursuant to the requirements of the Louisiana Air Quality Regulations.

### BEST AVAILABLE CONTROL TECHNOLOGY

PM/PM<sub>10</sub>, SO<sub>2</sub>, NO<sub>x</sub>, CO, and VOC emissions are above PSD significance levels and must undergo PSD analyses. The selection of control technology was based on the BACT analysis using a "top down" approach and included consideration of control of toxic materials.

BACT was determined to be:

Unit	Unit Identifiers	PM <sub>10</sub> BACT	NO <sub>x</sub> BACT	SO <sub>2</sub> BACT	CO BACT	VOC BACT
Blast Furnace / Hot Blast Stoves	STV-101, 102	Fuel gas cleaning with cyclone and wet scrubber	Low-NO <sub>x</sub> fuel combustion	No feasible control technology for Blast Furnace Gas. (BFG) Limit Nat. Gas sulfur content	Good combustion practices	Good combustion practices
Cast House	CST-101, 201	Local collection hoods and fabric filter		No feasible control technology	No feasible control technology	
Coke Oven Gas	COK-111, 211	Fabric filter	Staged combustion	Low Sulfur Coal, Lime spray drying scrubber	Good combustion practices	Good combustion practices
Blast Furnace & Coke Oven Coal Prep.	PCI-101 COK-100, 104, 204	Fabric filter, water suppression and enclosed conveyors				
Coke Oven Charging	COK-101, 201	Compacted coal, negative pressure ovens				
Coke Oven Pushing	COK-102, 202	Flat car pushing	Compacted coal and flat car pushing	Compacted coal and flat car pushing	Compacted coal and flat car pushing	Compacted coal and flat car pushing
Coke Quenching	COK-103, 203	Quench Tower Baffles and Low-TDS Water				

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<b>Unit</b>	<b>Unit Identifiers</b>	<b>PM<sub>10</sub> BACT</b>	<b>NO<sub>x</sub> BACT</b>	<b>SO<sub>2</sub> BACT</b>	<b>CO BACT</b>	<b>VOC BACT</b>
Slag Granulation	SLG-101, 102, 201, 202, 301, 306, 401	Water suppression of dust generating sources				
Slag Milling / Processing	SLG-302, 303, 304, 305, 402, 403, 404, 406, 407, 408, 409	Fabric filters				
Diverted Air-Cooled Slag	SLG-104, 105, 106, 204, 205, 206	Wet suppression of dust generating sources				
Topgas Boilers	PWR-101- 108	Fuel cleaning with cyclone and wet scrubber	Low-NO <sub>x</sub> fuel combustion	No feasible control technology for BFG Limit Nat. Gas sulfur content	Good combustion practices	Good combustion practices
Sinter Plant	SIN-101, 102	Collection systems and fabric filter	No feasible control technology	Lime spray drying scrubber	Good combustion practices	Counterflow injection of additives
Cooling Towers	TWR-101, 102, 103	Cellular drift eliminators and low TDS cooling water				
Storage Piles	PIL-101, 102, 103, 104, 105, 106, 107, 108	Wet suppression of dust generating sources. Paved roads where practicable and reduced speed limit				
Road Dust	FUG-101, 102					
Hot Metal Handling	PIG-101, 102	Collection hood and fabric filter				
Stock House; Sinter Material Handling	SIN-103, 105, 106; STC-101, 201	Fabric filters				
Material Handling and Transfer	COK-112, 113, 212, 213, 214, 215; DOC-101, 102; DST-101, 201; FUG-103; TRN-101	Enclosed conveyors and water suppression				

**AIR QUALITY IMPACT ANALYSIS**

Prevention of Significant Deterioration regulations require an analysis of air quality for those

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pollutants emitted in significant amounts from a proposed facility.

Dispersion Model Used: AERMOD

Pollutant	Time Period	Calculated Maximum Ground Level Concentration (Nucor plus Background)	Calculated Maximum Ground Level Concentration (Nucor Contribution)	National Ambient Air Quality Standard {NAAQS}
PM <sub>10</sub>	24 - hour	388.4 µg/m <sup>3</sup>	3.14 µg/m <sup>3</sup>	150 µg/m <sup>3</sup>
SO <sub>2</sub>	3 -hour	1693.2 µg/m <sup>3</sup>	14.4 µg/m <sup>3</sup>	1,300 µg/m <sup>3</sup>
SO <sub>2</sub>	24 - hour	630.8 µg/m <sup>3</sup>	4.72 µg/m <sup>3</sup>	365 µg/m <sup>3</sup>
SO <sub>2</sub>	Annual	88.5 µg/m <sup>3</sup>	0.18 µg/m <sup>3</sup>	80 µg/m <sup>3</sup>
NO <sub>x</sub>	Annual	60.2 µg/m <sup>3</sup>	-	100 µg/m <sup>3</sup>
CO*	1-hr	1194.4 µg/m <sup>3</sup>	-	40,000 µg/m <sup>3</sup>
CO*	8-hr	475.7 µg/m <sup>3</sup>	-	10,000 µg/m <sup>3</sup>

### ADDITIONAL IMPACTS

Soils, vegetation, and visibility will not be adversely impacted by the proposed facility, nor will any Class I area be affected. The project will not result in any significant secondary growth effects. Approximately 875 new permanent jobs will be created.

### PROCESSING TIME

Application Dated: May 12, 2008

Application Received: May 12, 2008

Additional Information Dated: August 6, 2008, August 7, 2008, August 8, 2008, August 11, 2008, August 12, 2008, August 13, 2008, August 25, 2008, August 26, 2008, September 24, 2008 and October 1, 2008

Effective Completeness Date: October 1, 2008

### PUBLIC NOTICE

A notice requesting public comment on the proposed project was published in *The Advocate*, Baton Rouge, Louisiana, on <<Date>>, 200x; and in <<Local Paper>>, <<City>>, Louisiana, on <<Date>>, 200x. Copies of the public notice were also mailed to individuals who have requested to be placed on the mailing list maintained by the Office of Environmental Services on <<Date>>, 200x. A proposed permit was also submitted to U.S. EPA Region VI on <<Date>>, 200x and to the Federal Land Manager on <<Date>>. All comments will be considered prior to a final permit decision.

## **PRELIMINARY DETERMINATION SUMMARY**

**Consolidated Environmental Management Inc - Nucor Steel Louisiana**

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**Consolidated Environmental Management Inc**

**Convent, St. James Parish, Louisiana**

**PSD-LA-740**

**October 1, 2008**

### **I. APPLICANT**

Consolidated Environmental Management Inc  
1915 Rexford Rd  
Charlotte, NC 28211

### **II. LOCATION**

Consolidated Environmental Management Inc - Nucor Steel Louisiana will be located near:

From I-10 & Hwy 22 go west on Hwy 22 to Hwy 70  
Go west 4.2 miles on Hwy 70 to Hwy 3125  
So south 2 miles on Hwy 3125 to Main Gate  
Convent, Louisiana

Approximate coordinates are Latitude 30° 5' 49", Longitude 90° 50' 38"

### **III. PROJECT DESCRIPTION**

The Nucor Steel Louisiana facility will use the blast furnace process to produce high quality pig iron. Nucor plans for the mill to reach an anticipated peak annual production rate of over six million metric tonnes of iron. The basic raw materials for the pig iron production process are iron ore, in lump or pellet form; coal; sinter; and flux, which may be limestone, dolomite, or electric arc furnace slag. The facility will process the coal into metallurgical-grade coke for use in the blast furnaces, at dedicated coke ovens on the site. The blast furnaces themselves are closed units with virtually no atmospheric emissions. The coke ovens follow the heat recovery design. A sinter plant will also be constructed at the site to recycle fine materials and dusts for increased raw material efficiency. By recovering heat from the coking process and combusting blast furnace gas in multiple boilers, the mill will produce enough electricity to completely provide for facility usage, and also provide some electrical export to the public utility grid.

The basic raw materials of the blast furnace process will be received by ship, barge, and rail, with additional supplies and materials being delivered by truck. Pig iron produced at the facility is stored on-site in outdoor storage piles. The iron is loaded onto trucks or rail cars and transported to the Mississippi River dock for shipment to customers by ship or barge. Coke fines from the coke handling areas will ship to customers, primarily by barge. Granulated slag and slag aggregate from the slag granulation area are shipped to customers by barge or rail. Pulverized slag from the slag granulation/milling area is shipped to customers, primarily by truck. Flue Gas Desulfurization (FGD) dust from the coke plant and sinter plant will be shipped to a landfill, primarily by truck.

In the coke production process, coal is subjected to high heat in a battery of ovens, with the object of thermally cracking the organic compounds in the coal, leaving only pure carbon, simple carbon

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compounds and remaining ash in the resulting coke. During the coking process, the volatile fractions of the coal are liberated, and are collectively known as coke oven gas. The gas is ducted from the oven chamber into the refractory oven walls and sole flues beneath the chamber, where combustion of the gas is completed. Nucor will utilize a non-recovery design of coke ovens, instead of the more typical byproduct recovery ovens. In either design, the process of liberating the volatile fraction of the coal is done in an oxygen-deprived atmosphere. In the non-recovery oven design, the coal volatiles are oxidized within the ovens by the addition of combustion air, and incinerated by the intense heat. The heat of combustion is released within the oven system, allowing non-recovery ovens to be self-sufficient with respect to energy. Non-recovery ovens are operated at a negative pressure, which results in no system leaks around oven doors and other interfaces.

The coke production process consists of the following production steps:

- Coal Preparation: coal from the storage piles will be crushed, screened, wetted and mixed in the coal preparation area. The coal will then be pressed into the shape of a large brick by hydraulic presses. The coal bricks will then be transported by a rail-mounted charging car to an oven for charging.
- Coal Charging: is where a pusher machine drives the coal into the oven.
- Coke Ovens: There will be two batteries of coke ovens with each battery containing 140 ovens. A coking cycle will last approximately fifty-four hours. Heat from the hot refractory in the oven begins the carbonization of the coal, and normally no external fuel is required once the ovens have reached operating temperature. The flue gas system routes the hot gases to heat recovery steam generators (HRSGs). These HRSGs produce high-pressure steam that will be routed to the steam turbine generators.
- Coke Pushing: At the end of each coking cycle, doors on the ends of the oven are opened and the hot coke is pushed from the oven by a ram which is extended from a pusher car. A mobile, flat quench car receives the hot coke. The quench car travels by rail, carrying the coke to the coke quench tower.
- Coke Quenching: The coke in the quench car, from the coke oven, will be positioned beneath one of the coke quench towers. There is one quench tower for each coke oven battery. At the quench tower, the hot coke is deluged with water to minimize any burning with exposure to the air. The hot steam generated from quenching is channeled by natural draft up the quench tower. Baffles in the tower structure help to retain as much of the cooling water as possible. Cooling water from the quenching process is collected beneath the quench car, filtered, and reused.
- Coke Handling and Storage: The quenched coke is discharged onto an inclined coke wharf to allow the coke to drain and cool before a conveyor belt carries it to a crushing and screening system. The sized coke is then transported by conveyor to the Stock House for storage. Emissions from the coke screening and crushing facilities are controlled by a baghouse.



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The blast furnace is a counter-current reactor in the form of a tall, shaft-type furnace where iron-bearing materials (such as iron ore and sinter) are reduced to iron (pig iron or hot metal). A typical burden feed consists of iron ore pellets, coke, sinter, and flux materials such as limestone or dolomite. The burden material is charged into the top of the furnace and slowly descends as hot metal is removed from the bottom. Hot metal is withdrawn from the furnace and separated into molten iron and slag in the cast house.

Blast furnace gas (BFG) is collected from off-takes at the top of the furnace. This gas contains a large fraction of carbon monoxide generated by the iron making reaction, as well as a sizeable fraction of hydrogen. After exiting the blast furnace, the blast furnace gas (topgas) passes through a cyclone dust catcher and dust removal system, followed by a wet scrubber system. Topgas is combusted in the hot blast stoves in order to heat the incoming blast air. Remaining topgas is burned as a fuel in power boilers to generate steam. The high pressure steam produced in the boilers will be used in steam turbines connected to electric generators. The electricity produced will likely be greater than the total site electrical requirements, and a portion may be transmitted to the public utility power grid.

Estimated emissions, in tons per year, are as follows:

<u>Pollutant</u>	<u>Emissions</u>	<u>PSD de minimis</u>	<u>Review required?</u>
PM	3,012.55	25	Yes
PM <sub>10</sub>	1,627.05	15	Yes
SO <sub>2</sub>	5,009.74	40	Yes
NO <sub>x</sub>	4,049.88	40	Yes
CO	29,406.15	100	Yes
VOC	403.14	40	Yes
Lead	0.375	0.6	No

### IV. SOURCE IMPACT ANALYSIS

A proposed net increase in the emission rate of a regulated pollutant above de minimis levels for new major or modified major stationary sources requires review under Prevention of Significant Deterioration regulations, LAC 33:III.509. PSD review entails the following analyses:

- A. A determination of the Best Available Control Technology (BACT);
- B. An analysis of the existing air quality and a determination of whether or not preconstruction or postconstruction monitoring will be required;
- C. An analysis of the source's impact on total air quality to ensure compliance with the National Ambient Air Quality Standards (NAAQS);

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- D. An analysis of the PSD increment consumption;
- E. An analysis of the source related growth impacts;
- F. An analysis of source related growth impacts on soils, vegetation, and visibility;
- G. A Class I Area impact analysis; and
- H. An analysis of the impact of toxic compound emissions.

### **A. BEST AVAILABLE CONTROL TECHNOLOGY**

Under current PSD regulations, an analysis of "top down" BACT is required for the control of each regulated pollutant emitted from each new major stationary source in excess of the specified significant emission rates. The top down approach to the BACT process involves determining the most stringent control technique available for a similar or identical source. If it can be shown that this level of control is infeasible based on technical, environmental, energy, and/or cost considerations, then it is rejected and the next most stringent level of control is determined and similarly evaluated. This process continues until a control level is arrived at which cannot be eliminated for any technical, environmental, or economic reason. A technically feasible control strategy is one that has been demonstrated to function efficiently on identical or similar processes. Additionally, BACT shall not result in emissions of any pollutant which would exceed any applicable standard under 40 CFR Parts 60 and 61.

For this project, BACT analyses are required for PM<sub>10</sub>, SO<sub>2</sub>, NO<sub>x</sub>, CO, and VOC emissions from the facility. Where PM<sub>10</sub> is addressed in the BACT analysis, it is assumed that particulate matter (PM) is also being considered.

### **BACT DETERMINATION FOR EMISSIONS FROM BLAST FURNACE AND HOT BLAST STOVES**

#### **BACT analyses for PM/PM<sub>10</sub>**

##### **Source ID – Description (EQT #)**

STV-101-Blast Furnace 1 Hot Blast Stoves Common Stack (RLP015)

STV-201-Blast Furnace 2 Hot Blast Stoves Common Stack (RLP016)

##### **Potentially Applicable Technology**

1. Fabric filter (baghouse)
2. Electrostatic Precipitator (ESP)

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3. Wet scrubber
4. Cyclone
5. Good combustion practices

### Fabric Filter (baghouse):

- A fabric filter or baghouse is one of the most efficient means of separating particles from a gas stream. The advantage of bag filters is that the efficiency is largely insensitive to the physical characteristics of the gas stream and changes in the dust loading. Baghouse installations are an industry standard for particulate controls.

Both positive and negative pressure baghouses have been used in the steel industry. Positive pressure baghouses operate at an internal pressure greater than atmospheric. In this configuration, the exhaust fans are located before the baghouse (i.e. "dirty side") and pull the air from the process in order to push the air through the baghouse. These systems vent to ambient air through a continuous ridge vent instead of a stack. Negative pressure baghouses operate at an internal pressure less than atmospheric. In this configuration, the exhaust fans are located after the baghouse (i.e. "clean side"), pull the air through the baghouse and exhaust to the ambient air through a central stack.

### Electrostatic Precipitator (ESP):

ESPs use an electrostatic field to charge particles contained in the gas stream. The charged particles then migrate to a grounded collection surface. The collection particles are then periodically dislodged from the collection surface by vibrating or rapping the collection surface. The dislodged particles are then collected in a hopper at the bottom of the ESP.

### Wet Scrubber:

In a wet scrubber, the gas stream is brought into contact with a scrubbing liquid, typically by spraying the liquid in a contacting tower to remove the particles, or by some other contact method. Inlet gas characteristics and dust properties are of primary importance. Wet scrubbers remove dust particles by capturing them in the liquid droplets, dissolving other pollutants in the liquid droplets, and have the ability to handle gaseous streams with high moisture content.

### Cyclones:

Centrifugal collectors use cyclonic action to separate particles from the gas stream. In a typical cyclone, the gas stream enters a vessel at an angle and is spun rapidly. The centrifugal force created by the circular flow throws the particles toward the wall of the cyclone. After striking the wall, these particles fall into a hopper located beneath the cyclone. Single-cyclone separators

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create a dual vortex to separate coarse particles from fine. The main vortex spirals downward and carries most of the coarser dust particles. The inner vortex created near the bottom of the cyclone spirals upward and carries finer dust particles. Multiclones consist of a number of small-diameter cyclones, operating in parallel and having a common gas inlet and outlet. Multiclones operate on the same principle as cyclones by creating a main downward vortex and an ascending inner vortex. Multiclones are more efficient than single cyclones because they are longer and smaller in diameter. The longer length provides longer residence time while the smaller diameter creates greater centrifugal force. These two factors result in better separation of dust particulates. The pressure drop of multiclone collectors is higher than that of single-cyclone separators.

### **Good Combustion Practices:**

Good combustion practices are used in areas where it is difficult to feasibly implement other control technologies.  $PM_{10}$  emissions from natural gas combustion are usually from large-molecular-weight hydrocarbons that are not fully combusted. Condensable organic  $PM_{10}$  can be best controlled through good combustion practices.

## **Step 2 – Eliminate Technically Infeasible Options**

### **Fabric Filter (baghouse):**

Fabric filters or baghouses are common in the iron and steel industry for most  $PM_{10}$  control applications. Baghouses often are capable of 99% removal efficiencies. Baghouse removal efficiency is relatively level across the particle size range. However, baghouses are not a good control option for gas streams which contain high moisture content, as condensation on the filter cake makes particulate matter difficult to remove from the fabric filter during the bag cleaning cycle. Dust build up occurs on the exterior of the bags, resulting in plugging and eventual premature deterioration of the fabric filters on an overly frequent basis. Blast furnace gas has a high moisture content, making baghouses a technically infeasible option.

### **Electrostatic Precipitator (ESP):**

ESP's are capable of 98% or higher particulate removal; however, several factors preclude their application to control  $PM_{10}$  from the blast furnace. ESP's are sensitive to the composition and physical characteristics of the particles to be collected in the gas stream. Iron particles adhere very strongly to the collection plate of the ESP due to their electromagnetic properties. They become very difficult to remove, and thus rapidly reduce ESP efficiency. Zinc and other metal compounds tend to foul ESP electrodes, also reducing effectiveness. In addition, the efficiency of an ESP is highly sensitive to variations in flow rate, solids loading, pressure, and temperature, variations that are inherent in the blast furnace process.

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Additionally, ESPs have a high capital cost, have very high electricity demands and require large amounts of maintenance, resulting in a relatively high down time compared to other control options. As a result, ESPs have long been considered a technically infeasible control option for PM<sub>10</sub> emissions from the combustion of blast furnace gas.

### Good combustion practices:

Filterable particulate emissions from gas combustion are low; therefore, it is considered technically infeasible to collect particulate from gas combustion. Particulate from gas combustion is usually from large-molecular-weight hydrocarbons that are not fully combusted. While condensable organic PM<sub>10</sub> can be controlled through good combustion practices, dusts from metal ores in the fuel gas stream are typically not able to be fully combusted. Good combustion practices may be technically feasible under the broadest interpretation of its meaning, but will provide only limited PM<sub>10</sub> emission reductions (less than 50%) for BFG combustion.

### **Step 3 – Rank Remaining Technically Feasible Control Options**

1. Cyclone and Wet Scrubber Combination - 99%
2. Wet Scrubber - 98%
3. Cyclone - 80%
4. Good Combustion Practices - < 50%

Potential control alternatives were reviewed for technical feasibility in controlling PM<sub>10</sub> emissions from the pig iron production facility. The highest remaining control option was determined to be the combination of a cyclone separator followed by a wet scrubber. PM<sub>10</sub> emissions can be reduced by up to 99% with the addition of a cyclone and wet scrubber combination. This combination is common in the industry for the control of PM<sub>10</sub> emissions from blast furnace gas combustion.

### **Step 4 – Evaluate Remaining Control Technologies**

#### Combined Cyclone and Wet Scrubber:

The prevalent industry control for blast furnace top gas is a multi-stage cleaning operation. In the multi-stage cleaning operation, blast furnace top gas passes first through a dry cyclone to remove the large particulate and a large percentage of the total particulate (about 60%). The cyclone step is followed by a high efficiency wet scrubber system. The combined controls are capable of achieving a 99% reduction in total particulate matter.

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### Wet Scrubber:

High-energy wet scrubbers are technically feasible but have some disadvantages. Scrubber systems have very high pressure drops that result in high system operating costs. They also require water treatment and sludge disposal that are not required for other PM<sub>10</sub> control options. However, wet scrubbers are able to accommodate large volumes of gas with high moisture contents, which make it a viable option for this application.

### Cyclones:

Cyclones are effective at removing large dust particles using centrifugal forces. However, fine dusts are typically not as effectively removed, due to the high gas stream velocity that must be established, often keeping smaller particles entrained in the stream. A cyclone would achieve greater efficiency if used in combination with another control technology.

### Good Combustion Practices:

As mentioned previously, good combustion practices for blast furnaces and hot blast stoves will only reduce PM<sub>10</sub> emissions by a limited amount (less than 50%). Therefore, it represents the least effective and desirable control option of the technically feasible control technologies under consideration.

## **Step 5 – Selection of BACT**

Based on the top-down BACT analysis, the best available control technology includes a cyclone followed by a wet scrubber. A cyclone will remove coarser particulate that may be difficult for the scrubber to remove on its own, and will not typically be affected by high moisture content in the gas stream. A wet scrubber can accommodate the large volumes of moist gas that are generated by the blast furnace process. Together, these two options provide the most viable scenario for PM<sub>10</sub> emissions control, by cleaning the blast furnace gas fuel stream prior to combustion. PM<sub>10</sub> emissions are also partially controlled by good combustion practices, but this cannot be relied upon as a primary control due to the nature of the system. BACT for the blast furnace top gas fuel stream is established as a concentration of PM  $\leq 0.002$  gr/dscf.

### **BACT analyses for NO<sub>x</sub>**

#### **Source ID – Description (EQT #)**

STV-101-Blast Furnace 1 Hot Blast Stoves Common Stack (RLP015)

STV-201-Blast Furnace 2 Hot Blast Stoves Common Stack (RLP016)

Hot blast stoves are a source of NO<sub>x</sub> emissions because they consume large quantities of fuel.

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NO<sub>x</sub> formation is often driven by, among other factors, high flame temperatures during combustion. However, the primary fuel is blast furnace gas, which is largely CO, has a low heating value, and contains a large portion of inerts (approximately 65%), factors that reduce flame temperature. Thus, the generation of NO<sub>x</sub> during BFG combustion results in uncontrolled NO<sub>x</sub> concentrations in the flue gas that tend to be low (27 ppmv or less according to literature sources), and thus the potential for NO<sub>x</sub> reduction is limited.

Use of the BFG as a fuel significantly increases the overall energy efficiency of the blast furnace, since less fossil fuel is used to heat the stoves, and the low-BTU BFG is used as fuel instead of being vented to the atmosphere (resulting in high CO emissions), or burned in a thermal oxidizer or flare to control CO emissions, wasting the remaining available energy in the gas.

### Potentially Applicable Technology

A search of USEPA's RBLC database revealed no entries for the control of NO<sub>x</sub> from blast furnace stoves. A review of available literature did not discover any applications of control technology to the combustion of blast furnace gas for the reduction of NO<sub>x</sub> emissions. The following list of control technologies represent technologies that have been used for the control of NO<sub>x</sub> from other combustion sources and in other industries.

1. Selective Catalytic Reduction (SCR)
2. Selective Non-Catalytic Reduction (SNCR)
3. Non-Selective Catalytic Reduction (NSCR)
4. EM<sub>x</sub> (SCONO<sub>x</sub>)
5. Low Excess Air (LEA) combustion
6. Low NO<sub>x</sub> Burners (LNB)
7. Low NO<sub>x</sub> Fuel Combustion (LNC)

### Selective Catalytic Reduction (SCR):

SCR is the most advanced of the potential flue-gas control technologies for reducing NO<sub>x</sub> emissions, and is the technology upon which the great majority of flue gas treatment units are based. SCR units use ammonia (NH<sub>3</sub>) to selectively reduce NO<sub>x</sub> to nitrogen and water. The ammonia, usually diluted with air or steam, is injected through a grid system into the flue gas stream, upstream of a catalyst bed. Operating temperatures between 500 and 800 °F are required of the gas stream at the catalyst bed, in order to carry out the catalytic reduction process. On the catalyst surface, the NH<sub>3</sub> reacts with NO<sub>x</sub> to form molecular nitrogen and water. Depending on system design, NO<sub>x</sub> removal rates of 80 to 90 percent are achievable.

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### Selective Non-Catalytic Reduction (SNCR):

SNCR is a post-combustion technique that involves injecting ammonia or urea into specific temperature zones in the upper furnace or connective pass of a boiler. A temperature of between 1,600 °F (870 °C) and 2,100 °F (1,150 °C) is required at the injection site for the process reaction to take place. The ammonia or urea reacts with NO<sub>x</sub> in the gas to produce nitrogen and water. Multiple injection locations may be required within several different zones of the boiler to respond to variations in the boiler operating conditions.

### Non-Selective Catalytic Reduction (NSCR):

Non-selective catalytic reduction is similar to SCR, yet operates with a different catalyst and under different process conditions. NSCR requires precise adjustments of process conditions such as oxygen content (0.2 – 0.7% O<sub>2</sub>) and temperature (800 – 1,200 °F), and works best with certain windows of inlet concentration for NO<sub>x</sub> (2,000 – 4,000 ppmv), CO (3,000 – 6,000 ppmv) and VOC (1,000 – 2,000 ppmv). These operating windows are necessary because the catalyst acts to react the NO<sub>x</sub>, CO and VOC with one another, reducing the emission of each. The catalytic reaction requires a certain temperature band, and the presence of a small amount of oxygen. However, at optimal conditions it has the potential to reduce emissions of NO<sub>x</sub>, CO and VOC simultaneously. It has seen use controlling emissions from internal combustion engines and nitric acid plants.

### EM<sub>x</sub> (SCONO<sub>x</sub>):

EM<sub>x</sub> is primarily a NO<sub>x</sub> control technology which works by oxidizing NO to NO<sub>2</sub>, and trapping the NO<sub>2</sub> molecules as nitrates or nitrites on a potassium carbonate catalyst bed. Carbon monoxide is also oxidized across the catalyst, to CO<sub>2</sub>. The catalyst bed must then be regenerated with a steam and hydrogen vapor stream, producing water and diatomic nitrogen. EM<sub>x</sub> operates best when treating gases that have a steady temperature, in the range of 300 – 700 °F. EM<sub>x</sub> has seen use as a Lowest Achievable Emission Rate (LAER) technology applied to combustion turbines.

### Low Excess Air (LEA):

LEA is a combustion modification technique in which NO<sub>x</sub> formation is inhibited by reducing the excess air to less than normal ratios. It reduces the local flame concentration of oxygen, thus reducing both thermal and fuel NO<sub>x</sub> formation. It is easily implemented and is used extensively in both new and retrofit applications, either singly or in combination with other control measures. It can be used with most fuels and firing methods. It decreases the volume of combustion air to be heated, allowing more heat of combustion to be transferred, thus lowering fuel requirements for a given output. To maintain proper control of the furnace pressure, positive pressure must be maintained in the furnace to prevent the influx of tramp air.



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### Low NO<sub>x</sub> Burners (LNB):

LNBs have been used since the early 1970s for thermal NO<sub>x</sub> control. These specially designed burners employ a variety of principles including LEA, off-stoichiometric (or staged) combustion (OSC), and flue gas recirculation (FGR). The objective in the application of LNBs is to minimize NO<sub>x</sub> formation while maintaining acceptable combustion of carbon and hydrogen in the fuel.

The differences between a low NO<sub>x</sub> burner and a burner featuring LEA or FGR, for example, are not always clear. In general, LNBs implement LEA, OSC, FGR, or a combination of these techniques. In a stricter sense, LNBs have been defined as burners that control NO<sub>x</sub> formation by carrying out the combustion in stages (OSC) and, further, by controlling the staging at and within the burner rather than in the firebox. Consistent with this definition, there are two distinct types of designs for LNBs: staged air burners and staged fuel burners. Staged air burners are designed to reduce flame turbulence, delay fuel/air mixing, and establish fuel-rich zones for initial combustion. The reduced availability of oxygen in the initial combustion zone inhibits fuel NO<sub>x</sub> conversion. Radiation of heat from the primary combustion zone results in reduced temperature as the final unburned fuel gases mix with excess air to complete the combustion process. The longer, less intense flames resulting from the staged stoichiometry lower peak flame temperatures and reduce thermal NO<sub>x</sub> formation.

### Low-NO<sub>x</sub> Fuel Combustion (LNC):

A low-NO<sub>x</sub> fuel is one which results in a lower generation rate of NO<sub>x</sub> over traditional fossil fuels, on an equal energy basis. Blast furnace gas is a low-NO<sub>x</sub> fuel, generating less than half of the NO<sub>x</sub> per unit of energy as natural gas. This property is due to the low-BTU value of BFG, which burns at a cooler temperature, preventing the formation of a majority of the NO<sub>x</sub> seen with natural gas combustion.

## **Step 2 – Eliminate Technically Infeasible Options**

The evaluation of these technologies must review whether the specific technology is available for the application and is effective at reducing NO<sub>x</sub> emissions from the hot blast stoves.

### Selective Catalytic Reduction (SCR):

Selective catalytic reduction has been demonstrated to control emissions of NO<sub>x</sub> in flue gas streams down to a level of about 30 ppmv. Control has not been demonstrated beyond this level at any efficiency. The concentration of NO<sub>x</sub> in the hot blast stove flue gas will already be near or below the level of control achievable by SCR. Therefore, SCR is not a feasible control technology for the control of NO<sub>x</sub> from the hot blast stoves.

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### Selective Non-Catalytic Reduction (SNCR):

SNCR can only be effectively when used in applications where the temperature of the gas stream is extraordinarily high, between 1,600 – 2,100 °F. Due to the low heating value of the blast furnace gas combusted in the hot blast stoves, the temperature of the flue gas never reaches temperatures in the effective range. Thus, SNCR is not a feasible control technology for the control of NO<sub>x</sub> from hot blast stoves.

### Non-Selective Catalytic Reduction (NSCR):

Non-selective catalytic reduction requires specific levels of several process parameters that are incompatible with the combustion of blast furnace gas in the hot blast stoves. The low oxygen range required by NSCR can only be achieved by restricting the available combustion air to stoichiometric levels. As discussed for low excess air combustion, the low heating value of the blast gas does not allow for combustion at low levels of combustion air. Additionally, levels of NO<sub>x</sub> and VOC in the flue gas stream are not within the range necessary, and the flue gas temperature leaving the stoves will not reach the level required, to promote the catalytic reaction. Thus NSCR is not a feasible control technology for the control of NO<sub>x</sub> from hot blast stoves.

### EM<sub>x</sub> (SCONO<sub>x</sub>):

EM<sub>x</sub> technology uses catalyst beds with narrow, honeycomb structures, which expand and contract with temperature in a sensitive manner. These expansions and contractions must be allowed for with complex expansion joints. Large temperature swings during operation can render the system ineffective as pass-through leaks develop within the catalyst modules. The hot blast stoves will operate in a cyclic fashion, such that the flue gas leaving the stoves will experience regular temperature swings between 180 – 400 °C (356 – 752 °F). Due to its sensitivity to temperature changes, EM<sub>x</sub> is a technically infeasible control technology for NO<sub>x</sub> from the hot blast stoves.

### Low Excess Air (LEA) combustion:

Flame stability is an inherent problem with burning BFG fuel. Natural gas must be added to the BFG in order to increase the BTU content and obtain a stable flame. The nature of the BFG fuel and the high CO content make low excess air an infeasible option. There were no instances in literature sources of LEA use for hot blast stoves.

### Low NO<sub>x</sub> Burners (LNB):

Low NO<sub>x</sub> burners limit the formation of NO<sub>x</sub> by staging the addition of air to create a longer, cooler flame. The combustion of BFG in the hot blast stoves requires the supplement of a small amount of natural gas in order to maintain flame stability and prevent flame-outs of the burners.

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The use of low NO<sub>x</sub> burners would attempt to stage fuel gas at the limits of combustibility, and would prevent the operation of the hot blast stoves. Thus, Low NO<sub>x</sub> burners are not a feasible control technology for the hot blast stoves.

### **Step 3 – Rank Remaining Technically Feasible Control Options**

The available control technologies were ranked according to their efficiencies. The efficiencies listed are in reference to natural gas combustion. No data was available for blast furnace gas combustion efficiency. Blast furnace gas is known to have a lower heating value than natural gas.

#### **1. Low NO<sub>x</sub> Fuel Combustion (LNC) – 50% - 67%**

Standard hot blast stove designs inherently incorporate low NO<sub>x</sub> technology (reduced flame temperature) and have a proven history. Literature sources cite the NO<sub>x</sub> concentration exiting the hot blast stoves at 27 ppmv (avg) or less. There are no instances in literature where SCR or SNCR have been applied to blast furnace gas combustion, and the technology has not been demonstrated in hot blast stove applications.

### **Step 4 – Evaluate Remaining Control Technologies**

Low NO<sub>x</sub> fuel combustion is the only remaining control technology, and reduces NO<sub>x</sub> by operating at a reduced flame temperature, which minimizes thermal NO<sub>x</sub> formation.

### **Step 5 – Selection of BACT**

Using the top-down BACT selection method, the inherent low NO<sub>x</sub> fuel combustion qualities of BFG is the only remaining option for controlling NO<sub>x</sub> emissions from the hot blast stoves. Additionally, a search of the RBLC produced no results for NO<sub>x</sub> emission add-on controls applied to hot blast stoves in the United States. Therefore, BACT is selected to be no additional controls beyond the low NO<sub>x</sub> fuel combustion technology inherent in the hot blast stove design. BACT is established as 0.06 lbs/MM Btu.

### **BACT analyses for SO<sub>2</sub>**

#### **Source ID – Description (EQT #)**

STV-101-Blast Furnace 1 Hot Blast Stoves Common Stack (RLP015)

STV-201-Blast Furnace 2 Hot Blast Stoves Common Stack (RLP016)

The blast furnace gas contains some sulfur dioxide as it exits the blast furnace. Therefore, the analysis of SO<sub>2</sub> removal technologies addresses treatment of the BFG prior to its combustion as fuel.

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### Potentially Applicable Technology

1. Wet Scrubber
2. Spray Dryer/Absorber (Dry Scrubber)
3. Dry Sorbent Injection

#### Wet Scrubber:

Wet scrubbers are designed to maximize contact between the exhaust gas and an absorbing liquid. The exhaust gas is scrubbed with a slurry composed of 5 - 15% CaO (lime) or CaCO<sub>3</sub> (limestone) in suspension. The SO<sub>2</sub> in the gas stream reacts to form CaSO<sub>3</sub> and CaSO<sub>4</sub>. The scrubbing liquor is continuously recycled to the scrubbing tower after fresh CaO or CaCO<sub>3</sub> has been added.

The types of scrubbers that can adequately disperse the scrubbing liquid include packed towers, plate or tray towers, spray chambers, and venturi scrubbers. In addition to CaSO<sub>3</sub> or CaSO<sub>4</sub>, numerous other absorbents are available including sodium bicarbonate solutions and NH<sub>3</sub> based solutions.

#### Spray Dryer/Absorber (Dry Scrubber):

An alternative to wet scrubbing is a process known as semi-dry scrubbing using a spray dryer. As in wet scrubbing, the gas phase SO<sub>2</sub> is removed by contact with the suitable reactant suspended in water. Typically, this may be an aqueous solution of Na<sub>2</sub>CO<sub>3</sub> or Ca(OH)<sub>2</sub>. In spray dryer systems, the solution is pumped to atomizers, which create a spray of very fine droplets. The droplets mix with the incoming SO<sub>2</sub> in the flue gas in a very large chamber, and subsequent absorption leads to the formation of sulfites and sulfates in the droplets. Almost simultaneously, the sensible heat of exhaust gas that enters the chamber evaporates the water in the droplets, leaving a fine dry powder before the gas leaves the spray dryer. Typically, baghouses employing Teflon-coated fiberglass bags (to minimize bag corrosion) are used to collect the precipitated particulates, which contain both reacted and unreacted products.

#### Dry Sorbent Injection:

Dry sorbent injection involves the addition of an alkaline material (usually hydrated lime or soda ash) into the gas stream to react with the acid gases. This control option typically involves the injection of dry powders into either the furnace or post furnace region of boilers. Higher collection efficiencies can be achieved by increasing the flue gas humidity. The technology is generally only effective at controlling gas streams with a high concentration of acid gases.

A search of the RBLC database was conducted to identify which control technologies are in place today in the U.S. for hot blast stoves. The results can be seen in the Table below.

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### ***RBLC Listings for SO<sub>2</sub> Emissions from Blast Furnace Gas Combustion***

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Severstal North America, Inc	MI-0377	Blast Furnace Stoves	No Controls Feasible Compliance Verification Via CEMS	NA	16.62	Lb/MMscf

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

### **Step 2 - Eliminate Technically Infeasible Options**

The design average concentration of SO<sub>2</sub> exiting the blast furnace is very low (14 ppmv) and is below the post-control SO<sub>2</sub> concentrations achieved in coal-fired utility boilers (100 to 150 ppmv typical for new facilities burning 2.5 to 3% sulfur coal). None of the control options discussed below are effective for removal of SO<sub>2</sub> at the low concentrations anticipated at the exit of the blast furnace.

#### **Wet Scrubber:**

Wet scrubbers are not effective at removing low concentration of SO<sub>2</sub> in a gas stream. Additionally, various operating problems are associated with the use of wet scrubbers to control SO<sub>2</sub> emissions from blast furnace and hot blast stove processes. When applied to the BFG prior to use as fuel in the hot blast stoves, there are potential problems with calcium scale plugging of the downstream burners. Particulates can plug scrubber spray nozzles, packing, plates, and trays. Wet scrubbers also require handling, treatment, and disposal of a sludge byproduct. In this case, a small reduction in air emissions would be exchanged for large-scale water treatment and solid waste disposal requirements.

#### **Spray dryer/Absorber (Dry Scrubber):**

The spray dryer process does not have the wastewater treatment problem associated with the wet scrubbing system, and the dry dust resulting from SO<sub>2</sub> removal can be easily removed downstream by a baghouse. However, spray dryers are not effective at removing low concentrations of SO<sub>2</sub> in a gas stream. Additionally, a small reduction in air emissions would be exchanged for a larger solid waste disposal requirement.

#### **Dry Sorbent Injection:**

Dry sorbent injection would not result in the wastewater treatment and disposal problems associated with the wet scrubbing systems. However, because of the very low SO<sub>2</sub> emission concentrations in the exhaust gas, it would not be feasible to design an efficient system of dry sorbent injection to the blast furnace process.

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### **Step 3- Rank Remaining Technically Feasible Control Options**

In the previous analysis, available control technologies were reviewed for application to the SO<sub>2</sub> removal process. There are no technically feasible options for the control of SO<sub>2</sub> from hot blast stoves remaining to be ranked.

### **Step 4 – Evaluate Remaining Control Technologies**

Various control alternatives were reviewed for technical feasibility in controlling SO<sub>2</sub> emissions from the blast furnace and hot blast stoves. The application of each of the potential control options to the process was considered. Each of the available options has been eliminated as technically infeasible. A search of the RBLC database did not list any control options in place for SO<sub>2</sub> removal from blast furnaces or blast stoves.

### **Step 5 – Selection of BACT**

A “top-down” BACT analysis was performed for SO<sub>2</sub> removal from the blast furnace / hot blast stoves. This analysis determined that BACT for SO<sub>2</sub> emissions from blast furnaces and hot blast stoves is no add-on or combustion control other than the low-sulfur BFG fuel. BACT is also established as a maximum limit of 0.039 gr/dscf for the Blast Furnace Top Gas fuel. BACT for natural gas is to purchase natural gas containing no more than 2500 grains of Sulfur per MM scf.

#### **BACT analyses for CO and VOC**

##### **Source ID – Description (EQT #)**

STV-101-Blast Furnace 1 Hot Blast Stoves Common Stack (RLP015)

STV-201-Blast Furnace 2 Hot Blast Stoves Common Stack (RLP016)

A discussion of CO and VOC controls is combined due to the similarity in approach for control of these emissions. Blast furnace gas leaves the furnace with a large percentage of carbon monoxide and some VOC. These gases are not emitted to the atmosphere from the blast furnace process, but are instead collected, cleaned of particulate matter, and used as fuel for the hot blast stoves as well as the topgas boilers. Because the stoves and boilers are designed specifically for the combustion of a large amount of CO, uncombusted CO leaving the stoves is minimized.

VOC is typically generated by combustion sources when organic fuels such as coal or petroleum-based liquids are incompletely combusted. As a result emissions can be minimized through the use of good combustion practices, including ensuring sufficient air-to-fuel ratios. Blast furnace gas is largely inorganic, and contains only small amounts of VOC. The use of add-on oxidation technologies such as after-burners can also be considered to reduce CO and VOC emissions.

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A search of the USEPA's RACT/BACT/LAER Clearinghouse was conducted to review control technologies that are in place today for several types of boilers. It can be seen that good combustion practices are the industry standard for controlling CO and VOC emissions from boilers. However, there are no recorded control efficiencies for this control. The Tables below provide a listing from the RBLC database of CO and VOC emissions limits and controls that are currently in place. The only technology in use for minimizing CO emissions is good combustion practices.

### ***RBLC Listings for CO Emissions from Blast Furnace/Hot Blast Stoves***

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Severstal North America, Inc.	MI-0337	Blast Furnace Stoves	Good Combustion Practices	None	84.0	lb/MMscf

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

### ***RBLC Listings for VOC Emissions from Blast Furnace/Hot Blast Stoves***

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Nucor Steel	IN-01018	Boiler, Nat. Gas	Compliance by Using Nat. Gas	NA	0.0026	lb/MMBtu
Steel Corr, Inc.	AR-0077	Boilers, Nat. Gas	Nat. Gas Combustion Only	NA	0.0055	lb/MMBtu
Charter Steel	WI-0181	Boiler	Good Combustion Control, Natural Gas	NA	No Limit	

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

### **Potentially Applicable Technology**

1. Catalytic Oxidizer
2. Non-Selective Catalytic Reduction (NSCR)
3. EM<sub>x</sub> (SCONO<sub>x</sub>)
4. Good Combustion Practices

### **Catalytic Oxidizer:**

Beyond combustion controls, the remaining CO and VOC could be oxidized to carbon dioxide (CO<sub>2</sub>) and water in a downstream control device. Gas streams with high concentrations of CO can be controlled by installing a catalytic oxidizer. The oxidation process occurs at a relatively low temperature by moving the gases across a bed of catalyst material consisting of a precious metal such as palladium. This can be practical when CO levels are elevated above 1,000 ppmv, such as in certain chemical processes, or combustion units that have a wet fuel or for some reason promote incomplete combustion.

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### Non-Selective Catalytic Reduction (NSCR):

Non-selective catalytic reduction is similar to SCR, yet operates with a different catalyst and under different process conditions. NSCR requires precise adjustments of process conditions such as oxygen content (0.2 – 0.7% O<sub>2</sub>) and temperature (800 – 1,200 °F), and works best with certain windows of inlet concentration for NO<sub>x</sub> (2,000 – 4,000 ppmv), CO (3,000 – 6,000 ppmv) and VOC (1,000 – 2,000 ppmv). These operating windows are necessary because the catalyst acts to react the NO<sub>x</sub>, CO and VOC with one another, reducing the emission of each. The catalytic reaction requires a certain temperature band, and the presence of a small amount of oxygen. However, at optimal conditions it has the potential to reduce emissions of NO<sub>x</sub>, CO and VOC simultaneously. It has seen use controlling emissions from internal combustion engines and nitric acid plants.

### EM<sub>x</sub> (SCONO<sub>x</sub>):

EM<sub>x</sub> is primarily a NO<sub>x</sub> control technology which works by oxidizing NO to NO<sub>2</sub>, and trapping the NO<sub>2</sub> molecules as nitrates or nitrites on a potassium carbonate catalyst bed. Carbon monoxide is also oxidized across the catalyst, to CO<sub>2</sub>. The catalyst bed must then be regenerated with a steam and hydrogen vapor stream, producing water and N<sub>2</sub>. EM<sub>x</sub> operates best when treating gases that have a steady temperature, in the range of 300 – 700 °F. EM<sub>x</sub> has seen use as a Low Achievable Emission Rate (LAER) technology applied to combustion turbines.

### Good Combustion Practices:

Carbon monoxide and VOC are a result of incomplete combustion; therefore, they can typically be minimized through the use of good combustion practices, including assurance of sufficient air-to-fuel ratios. Good combustion practices can be enhanced using staged combustion, which involves the injection of combustion air at different areas of the burners.

A search of the RBLC database was conducted and no records were found for add-on emissions controls for CO or VOC from blast furnaces or hot blast stoves.

## **Step 2 – Eliminate Technically Infeasible Options**

### Catalytic Oxidizer:

In the case of a gas fired burner, an afterburner or downstream oxidizer would not result in an emission reduction because CO emissions typically are less than 1,000 ppmv. Further oxidation would generate more NO<sub>x</sub> emissions and have little impact on CO.



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### Non-Selective Catalytic Reduction (NSCR):

Non-selective catalytic reduction requires specific levels of several process parameters that are incompatible with the combustion of blast furnace gas in the hot blast stoves. The low oxygen range required by NSCR can only be achieved by restricting the available combustion air to stoichiometric levels. As discussed for low excess air combustion, the low heating value of the blast gas does not allow for combustion at low levels of combustion air. Additionally, levels of  $\text{NO}_x$  and VOC in the flue gas stream are not within the range necessary, and the flue gas temperature leaving the stoves will not reach the level required, to promote the catalytic reaction. Thus NSCR is not a feasible control technology for the control of CO from hot blast stoves.

### EM<sub>x</sub> (SCONO<sub>x</sub>):

EM<sub>x</sub> technology uses catalyst beds with narrow, honeycomb structures, which expand and contract with temperature in a sensitive manner. These expansions and contractions negatively impact the performance of EM<sub>x</sub>, and large temperature swings during operation can render the system ineffective. The hot blast stoves will operate in a cyclic fashion, such that the flue gas leaving the stoves will experience regular temperature swings between 180 – 400 °C (356 – 752 °F). Due to its sensitivity to temperature changes, EM<sub>x</sub> is a technically infeasible control technology for the hot blast stoves.

### **Step 3 – Rank Remaining Technically Feasible Control Options**

1. Good combustion practices – 98 - 99% CO and 40 – 60% VOC (typical)

### **Step 4 – Evaluate Remaining Control Technologies**

In blast furnaces and hot blast stoves, good combustion practices can lead to an overall CO and VOC reduction efficiency of 98 – 99% and 40 – 60%, respectively. A review of the RBLC database indicates that good combustion practice is the control method of choice for controlling CO and VOC emissions from other types of furnaces. Good combustion operation practices are considered the only feasible control method for reducing CO and VOC emissions.

### **Step 5 – Selection of BACT**

Using the top-down BACT selection method, only one option remains for the control of CO and VOC from the blast furnace and hot blast stoves. BACT is selected to be good combustion practices during the operation of the blast furnace and hot blast stoves. BACT is also selected as 0.0824 lbs of CO per MM Btu, and 0.0054 lbs of VOC per MM Btu.

## **PRELIMINARY DETERMINATION SUMMARY**

**Consolidated Environmental Management Inc - Nucor Steel Louisiana  
Agency Interest No.: 157847**

**Consolidated Environmental Management Inc  
Convent, St. James Parish, Louisiana**

**PSD-LA-740**

**October 1, 2008**

### **BACT DETERMINATION FOR CAST HOUSE**

#### **BACT analyses for PM<sub>10</sub>**

##### **Source ID – Description (EQT #)**

CST-101- Cast House 1 Baghouse Vent (EQT015)

CST-201- Cast House 2 Baghouse Vent (EQT016)

In the cast house, the taphole of the blast furnace is periodically drilled open in an operation called tapping or casting. The iron metal and slag mixture exits at a temperature of 1,300 – 1,500 °C. The hot iron metal and slag is drained from the taphole through a runner system into ladles waiting on wheeled cars. The slag floats to the top of the trough, and a dam separates the hot metal and slag into two separate streams. The slag is drained by separate runners into a granulation system for cooling, or to an open pit for later reclaiming and processing.

Iron oxide dust emissions are frequently generated during casting either by direct vaporization of the compounds or the partial pressure of CO bursting bubbles at the metal to atmosphere interface. Additional emissions are generated from the drilling out of the clay taphole plug and replacement of the taphole plug at the completion of the casting operation.

Casting operations are the main source of emissions at the cast house. Emissions are generated by drilling and plugging the taphole in the hearth of the blast furnace and from casting operations, as a result of the transfer of hot metal from the runner to the ladle. Particulate emissions are also generated when the molten iron and slag contact air above their surface.

#### **Step 1 – Identify Potential Control Technologies**

The technologies that are potentially available to control PM<sub>10</sub> emissions from the cast house are typical of industrial dust control technologies, and include local collection hoods venting to one of the following:

1. Fabric Filter (baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubber
4. Cyclone

A search of the RBLC database was conducted to review what controls are in place today in the United States. The results can be seen in the Table below.

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### ***RBLC Listings for PM<sub>10</sub> Emissions from the Cast House***

<b>Facility</b>	<b>RBLC ID</b>	<b>Unit</b>	<b>Control Technology</b>	<b>Control Efficiency</b>	<b>Emission Limit</b>	<b>Units</b>
Quanex Corporation - Macsteel Division	AR-0021	Caster	Fabric Filter	99.5%	0.0018	gr/dscf
Steelcorr, Inc.	AR-0077	Caster	Fabric Filter		0.0018	gr/dscf
Asama Coldwater Manufacturing, Inc.	MI-0385	Casting Cooling and Shot Blast Machine	Hoods, Enclosures, Ductwork and a 65,360 ACFM Baghouse	99%	2.64	lb/hr
Charter Manufacturing Co., Inc.	OH-0276	Continuous Caster	Baghouse	NA	1.1 3.55	lb/hr TPY
Nucor Yamato Steel	AR-0091	Castrip Caster	Baghouse		0.0053	gr/dscf
Nucor Jewett Plant	TX-0398	Continuous Caster	Baghouse		0.29 0.68	lb/t TPY

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

### **Step 2 – Eliminate Technically Infeasible Options**

The evaluation for these filtering technologies must review whether the specific technology is available for the application and is effective at reducing PM<sub>10</sub> emissions from the casting process.

#### Electrostatic Precipitator (ESP):

ESP's are capable of 98% or higher particulate removal, however several factors preclude their application to control PM<sub>10</sub> from the cast house. ESPs are sensitive to the physical characteristics of the gas stream, and the control efficiency is highly sensitive to variations in flow rate, solids loading, pressure, and temperature that are inherent in the cast house operations. ESPs are especially sensitive to the composition of the particles to be collected. Iron particles adhere very strongly to the collection plate of an ESP due to their electromagnetic properties. They become very difficult to remove and thus quickly reduce ESP efficiency. Additionally, ESPs have a high capital cost, high electricity demands and require large amounts of maintenance, resulting in a relatively high down time. ESPs are a technically infeasible control option for this source.

### **Step 3 – Rank Remaining Technically Feasible Control Options**

The control technologies that are potentially available to control PM<sub>10</sub> emissions from the cast house are ranked below according to their respective control efficiencies.

1. Fabric Filter (baghouse) – 99%
2. Wet Scrubber – 98%

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### 3. Cyclone – 80%

Various control alternatives were reviewed for technical feasibility in controlling PM<sub>10</sub> emissions from the cast house. The highest ranking control option was identified to be the baghouse. PM<sub>10</sub> emissions could be reduced by up to 99% with the addition of local collection hoods and baghouse filters. A review of the RBLC database indicated that fabric filters or baghouses with hoods and enclosures have been routinely accepted as BACT.

#### **Step 4 – Evaluate Remaining Control Technologies**

##### Fabric Filter (baghouse):

Local collection hood and fabric filters or baghouses are the most efficient means of removing particulate from the cast house sources. The advantage of local collection hoods and bag filters is that air flows can be adjusted individually to accommodate changes in the dust loading. Local collection hoods and baghouse installations are the industry standard for particulate controls.

##### Wet Scrubber:

High-energy wet scrubbers are technically feasible but have many disadvantages compared to fabric filters, which can achieve better levels of particulate control. Scrubber systems have very high pressure drops that result in high system operating costs. They also require water treatment and sludge disposal, which are not necessary with the other PM<sub>10</sub> control options. They also have large space requirements.

##### Cyclones:

The dust particles could be separated by centrifugal forces imparted in a cyclone, however high velocities must be established and fine dust would not be effectively removed with the greatest efficiency.

#### **Step 5 – Selection of BACT**

A top-down BACT analysis was performed for PM<sub>10</sub> emissions from the cast house. The most efficient control of PM<sub>10</sub> emissions from the cast house is the local collection hoods and fabric filter option. BACT is selected to be local collection hoods and baghouse filter at 0.013 lbs of PM per ton of hot metal, which is less than the emission standard from NESHAP 40 CFR 63 Subpart FFFFF of 0.003 gr/dscf.

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### **BACT analyses for SO<sub>2</sub>**

#### **Source ID – Description (EQT #)**

CST-101- Cast House 1 Baghouse Vent (EQT015)

CST-201- Cast House 2 Baghouse Vent (EQT016)

The molten iron and slag tapped from the blast furnace contain sulfur and sulfur compounds dissolved or entrained in the liquid. These compounds, upon contact with air, have the potential to form SO<sub>2</sub>. Air above the tapholes and casting runners is collected via large suction hoods, primarily for the purpose of dust control. Although emissions of SO<sub>2</sub> in aggregate are in excess of the PSD significance level, the calculations of the expected concentration of SO<sub>2</sub> in the Cast House Dedusting vents were performed and are very low (~4 ppm). This concentration is a consequence of the enormous volume of air being collected for dedusting from the open hoods above each tap hole (1,200,000 cubic meters per hour per blast furnace).

#### **Step 1 – Identify Potential Control Technologies**

##### **1. No control**

A search of the RBLC Database did not find an instance where controls have been applied to SO<sub>2</sub> emissions from casting operations. Similarly, no instances of a control technology or technique were found in a review of industry and academic literature. Since no technology or technique has been identified with a practical potential for reducing emissions of SO<sub>2</sub> from the casting process, the only remaining option is no control. For this reason, steps 2 – 4 of the BACT Analysis have been omitted.

BACT is selected as no additional control and as 0.04 lbs of SO<sub>2</sub> per ton of hot metal.

### **BACT analyses for CO**

#### **Source ID – Description (EQT #)**

CST-101- Cast House 1 Baghouse Vent (EQT015)

CST-201- Cast House 2 Baghouse Vent (EQT016)

The molten iron and slag tapped from the blast furnace contain carbon and carbon compounds dissolved or entrained in the liquid. These compounds, upon contact with air, have the potential to form carbon monoxide. Although emissions of CO in aggregate are in excess of the PSD significance level, the calculations of the expected concentration of CO in the Cast House Dedusting vents were performed and are very low (~12 ppm). This concentration is a consequence of the enormous volume of air being collected for dedusting from the open hoods above each tap hole (1,200,000 cubic meters per hour per blast furnace).

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### Step 1 – Identify Potential Control Technologies

#### 1. No Control

A search of the RBLC Database did not find an instance where controls have been applied to CO emissions from casting operations. Similarly, no instances of a control technology or technique were found in a review of industry and academic literature. Since no technology or technique has been identified with a practical potential for reducing emissions of CO from the casting process, the only remaining option is no control. For this reason, steps 2 – 4 of the BACT Analysis have been omitted.

BACT is selected as no additional controls and as 0.055 lbs of CO per ton of hot metal.

### BACT DETERMINATION FOR EMISSIONS FROM COKE OVENS

#### BACT analyses for PM<sub>10</sub>

##### **Source ID – Description (EQT #)**

COK-111-Coke Battery 1 Flue Gas Desulfurization Stack (RLP006)

COK-211-Coke Battery 2 Flue Gas Desulfurization Stack (RLP012)

There are several processes that take place in the coke ovens including heating, charging, and pushing.

Metallurgical coke is produced by the destructive distillation of coal in coke ovens. Prepared coal is heated in an oxygen-free atmosphere (coked) until most volatile components in the coal are removed. The remaining material is a carbon mass called coke.

There are two types of coke processes:

- The “byproduct” process is designed to recover the organic components gasified during the coking process;
- The “non-recovery” process uses the volatile organics from the coking process as fuel to heat the coal and drive the coking process.

The process for Nucor Steel Louisiana is a non-recovery coke process in which the coke oven gas is combusted in the ovens to drive the coking process.

The proposed coke oven is a non-recovery coke oven battery design. Heating and distillation of the compressed coal to form coke is accomplished in the coke ovens. Coke oven gas, which is generated from the distillation of coal, is combusted as fuel to provide heat for the distillation process. The flue gas stream leaving the coke ovens is sent to heat recovery steam generators (HRSGs) prior to controls.

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The non-recovery coke ovens are operated at a negative pressure, and emissions from coke oven battery doors inherent with byproduct recovery ovens largely do not exist.

### Step 1 – Identify Potential Control Technologies

1. Fabric Filters (baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubber
4. Cyclone

### *RBLC Listings for PM<sub>10</sub> Emissions from Coke Oven Gas*

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
FDS Coke	OH-0297	Coke Oven Batteries	Fabric Filter	99%	39.0 171.0	lb/hr t/yr
Haverhill North Coke Company	OH-0297	Coke Battery Ovens	Baghouse	99%	43.89 0.008	lb/hr gr/dscf
Haverhill North Coke Company	OH-0305	Coke Oven Batteries, Non-recovery	Baghouse	99%	17.14 75.08 0.008	lb/hr t/yr gr/dscf

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

### Step 2 – Eliminate Technically Infeasible Options

Each PM<sub>10</sub> removal option was determined to be technically feasible.

### Step 3 – Rank Remaining Technically Feasible Control Options

1. Fabric Filter (baghouse) - 99%
2. Electrostatic Precipitator (ESP) - 98%
3. Wet Scrubber - 98%
4. Cyclone - 80%

Various control alternatives were reviewed for technical feasibility in controlling PM<sub>10</sub> emissions from coke oven gas. The highest ranking control option was identified to be a fabric filter. PM<sub>10</sub> emissions could be reduced by up to 99% with the addition of baghouse filters.

### Step 4 – Evaluate Remaining Control Technologies

#### Fabric Filter (baghouse):

A fabric filter or baghouse is one of the most efficient means of separating particles from a gas stream. Baghouse effectiveness is frequently 99% or greater under the correct operating conditions. The advantage of bag filters is that the efficiency is largely insensitive to changes in

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the dust loading. However, baghouse controls can have special capital demands to handle high temperature vent streams. Baghouse installations are the industry standard for particulate controls.

### Electrostatic Precipitator (ESP):

ESPs are capable of 98% or higher particulate removal; however there are several disadvantages to their application to control PM<sub>10</sub> from coke oven gas. ESPs have very high electricity demands and require large amounts of maintenance, resulting in a relatively high down time. In addition, ESPs have a high capital cost, and efficiency is highly sensitive to variations in flow rate, solids loading, pressure, and temperature that are inherent in coke oven operations.

### Wet Scrubber:

High-energy wet scrubbers are technically feasible but have many disadvantages compared to fabric filters, which can achieve better levels of particulate control. Scrubber systems have very high pressure drops that result in high system operating costs. They also require water treatment and sludge disposal, which are not necessary with other PM<sub>10</sub> control options. They also tend to have large space requirements.

### Cyclones:

The dust particles could be separated by centrifugal forces imparted in a cyclone, however high velocities must be established and fine dust would not be effectively removed with the greatest efficiency.

## **Step 5 – Selection of BACT**

A top-down BACT analysis was performed for the coke oven gas and BACT is selected to be a fabric filter. The coke oven flue gas will be captured and routed through a baghouse before release to the atmosphere. BACT is selected as 0.01726 lbs of PM<sub>10</sub> per ton of coal charged.

### **BACT analyses for NO<sub>x</sub>**

#### **Source ID – Description (EQT #)**

COK-111-Coke Battery 1 Flue Gas Desulfurization Stack (RLP006)

COK-211-Coke Battery 2 Flue Gas Desulfurization Stack (RLP012)

Coke ovens produce metallurgical coke from coal by the distillation of volatile matter. A byproduct of the process is coke oven gas, which is used as a fuel to fire the ovens. NO<sub>x</sub> emissions from coking or coal combustion are primarily nitric oxide, with only a fraction of the NO<sub>x</sub> present as nitrogen dioxide. NO<sub>x</sub> is formed from the thermal reaction of nitrogen in



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combustion air in the combustion flame and from oxidation of nitrogen compounds in the coal. NO<sub>x</sub> formed from the thermal reaction is dependent on temperature, oxygen, and residence time. Thermal formation of NO<sub>x</sub> is complex, but the rate is significant at temperatures above 2,800 °F.

Although NO<sub>x</sub> emissions tend to be minimized by slow mixing in the combustion chamber, they are nonetheless substantial because of the large quantity of fuel consumed. Coke ovens are among the major NO<sub>x</sub> emission sources at iron and steel mills.

### Step 1 – Identify Potential Control Technologies

1. Selective Catalytic Reduction (SCR)
2. Selective Non-Catalytic Reduction (SNCR)
3. Non-Selective Catalytic Reduction (NSCR)
4. EM<sub>x</sub> (SCONO<sub>x</sub>)
5. Low NO<sub>x</sub> Burners (LNB)
6. Staged Combustion

### *RBLC Listings for NO<sub>x</sub> Emissions from Coke Oven Gas*

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
FDS Coke	OH-0297	Coke Oven Batteries	Staged Combustion	NA	49.6 217.2	lb/hr t/yr
Haverhill North Coke Co.	OH-0272	Coke Battery Ovens	Staged Combustion	85%	675.0 1.0	lb/hr lb/T of coal
Haverhill North Coke Co.	OH-0305	Coke Oven Batteries	Staged Combustion	NA	120.0 438.0	lb/hr t/yr

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

### Step 2 – Eliminate Technically Infeasible Options

#### Low NO<sub>x</sub> Burners (LNB):

The effectiveness of a low NO<sub>x</sub> burner is different for boilers than for a coke oven. External fuel is burned in a boiler where operating conditions can be carefully controlled. In a coke oven, the volatile fraction of the coal migrates from the coal bed, and the gases are burned inside the oven gas collection system. The coal bed is converted to a coke bed over the cycle, and remains in the oven. LNBs are not technically feasible for coke ovens because neither the coke oven gas, nor the coal itself, is combusted through burners.

#### Selective Catalytic Reduction (SCR):

For SCR to be effective, the waste gas stream must be between the temperatures of 600 – 800 °F.

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Unlike utility boilers with economizers and air heaters, coke ovens do not contain sections within the unit where the temperature is in the range where SCR can be used. Also, the catalyst bed of an SCR unit is highly sensitive to particulate matter in the gas stream, which plugs and fouls the catalyst. SCR has not been used with the coking process to date for these reasons, and is considered to be technically infeasible.

### Selective Non-Catalytic Reduction (SNCR):

SNCR requires injection of a reagent into the gas stream. In the case of the coking process, the required temperature window for this to take place (i.e., 1,600 – 2,200 °F) is only available for a brief period of time during the combustion cycle and may occur in any of several ducts along the coke oven battery at different times. It is thus difficult to inject the reagent into the gas stream that is within the temperature window, since the location is highly variable. If the injection takes place outside the temperature window, the SNCR will not be an effective technology. SNCR has not been used with the coke oven process to date for these reasons.

### Non-Selective Catalytic Reduction (NSCR):

Non-selective catalytic reduction requires specific levels of several process parameters that are incompatible with the combustion of coke oven gas in the hot blast stoves. Carbon monoxide and VOCs are almost entirely incinerated in the coking ovens, and concentrations in the flue gas stream will not be within the ranges necessary to promote the catalytic reaction. Thus, NSCR is not a feasible control technology for the control of NO<sub>x</sub> from the coke ovens.

### EM<sub>x</sub> (SCONO<sub>x</sub>):

EM<sub>x</sub> technology uses catalyst beds with narrow, honeycomb structures. These catalyst beds are sensitive to temperature, and cannot operate at temperatures in excess of 1,200 °F. Additionally, the catalyst beds are prone to fouling in applications containing significant particulate loadings. The coke oven flue gas leaving the ovens will exceed the temperature limitations of EM<sub>x</sub>. Additionally, the flue gas leaving the coke oven desulfurization units will contain an amount of lime particulate which would quickly cause plugging and fouling of the intricate catalyst beds, due to scale formation. Therefore, EM<sub>x</sub> is a technically infeasible control technology for the coke ovens.

## **Step 3 – Rank Remaining Technically Feasible Control Options**

Staged combustion is the only NO<sub>x</sub> control technology that is technically feasible for the coke oven gas.

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### **Step 4 – Evaluate Remaining Control Technologies**

#### Staged Combustion:

Staged combustion controls NO<sub>x</sub> by limiting the oxygen present at temperatures where NO<sub>x</sub> formation is likely and/or suppressing peak temperatures that increase NO<sub>x</sub> formation during gas combustion. The proposed non-recovery coke ovens use two discrete regions for staged combustion of the coal volatiles. The regions are the crown and the sole flues. The crown is the first stage of air addition. This operates in a reducing atmosphere where minimal oxygen is present for NO<sub>x</sub> formation. The sole flues receive secondary air and operate in a reducing or oxidizing atmosphere as dictated by the oven gas rates. NO<sub>x</sub> formation is minimized in the flues by controlling the temperature and air input.

### **Step 5 – Selection of BACT**

A top-down BACT analysis was performed for control of NO<sub>x</sub> from the coke ovens. After review of available control technologies, staged combustion was selected as BACT. BACT is selected as 0.71 lbs of NO<sub>x</sub> per ton of coal charged.

#### **BACT analyses for SO<sub>2</sub>**

##### **Source ID – Description (EQT #)**

COK-111-Coke Battery 1 Flue Gas Desulfurization Stack (RLP006)

COK-211-Coke Battery 2 Flue Gas Desulfurization Stack (RLP012)

The primary source of sulfur oxide emissions from the project is the coke oven combusted gas. A top-down BACT analysis was performed for SO<sub>2</sub> from the coke oven flue gases. Due to the non-recovery design selected for the coke ovens, the flue gases will be effectively incinerated as they leave the coke ovens, and thus reduced sulfur compounds are not expected.

Sulfur compounds are released along with the volatile fraction of the coal as the coking cycle proceeds; however, about half of the sulfur in the coal remains in the coke product. Pre-combustion controls are technologies that prevent the formation of SO<sub>2</sub> during the combustion process (e.g. low-sulfur coal), while post-combustion controls work to clean SO<sub>2</sub> from the flue gas. Thus post-combustion controls are add-on controls that are used to either collect the pollutants or convert the pollutants to another form (e.g., lime added to SO<sub>2</sub> gas) to form solid calcium sulfite (CaSO<sub>3</sub>) and calcium sulfate (CaSO<sub>4</sub>). Note that these post-combustion controls are also effective at removing PM<sub>10</sub>.

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### Step 1 – Identify Potential Control Technologies

Four options were identified that could potentially be used to control SO<sub>2</sub> from the thermal distillation of coal during the coking process.

1. Wet Scrubber
2. Lime Spray Dryer/Absorber (Dry Scrubber)
3. Dry Sorbent Injection
4. Low-sulfur coal

#### Wet Scrubber:

Wet scrubbers are designed to maximize contact between the exhaust gas and an absorbing liquid. The exhaust gas is scrubbed with 5 to 15% slurry, composed of CaO or CaCO<sub>3</sub> in suspension. The SO<sub>2</sub> in the exhaust gas reacts with the CaO to form CaSO<sub>3</sub> and CaSO<sub>4</sub>. The scrubbing liquor is continuously recycled to the scrubbing tower after fresh CaO or CaCO<sub>3</sub> has been added.

The types of scrubbers that can adequately disperse the scrubbing liquid include packed towers, plate or tray towers, spray chambers, and venturi scrubbers. In addition to CaSO<sub>3</sub> or CaSO<sub>4</sub>, numerous other absorbents are available, including sodium solutions and NH<sub>3</sub> based solutions.

#### Lime Spray Dryer/Absorber (Dry Scrubber):

An alternative to wet scrubbing is a process known as semi-dry scrubbing using a spray dryer. As in wet scrubbing, the gas phase SO<sub>2</sub> is removed by contact with a suitable reactant. Typically, this may be an aqueous solution of Ca(OH)<sub>2</sub> or Na<sub>2</sub>CO<sub>3</sub>. In spray dryer systems, the solution is pumped through atomizers, which create a spray of very fine droplets. The droplets mix with the incoming SO<sub>2</sub> in the flue gas in a very large chamber, and the subsequent absorption of SO<sub>2</sub> leads to the formation of sulfites and sulfates in the droplets. Almost simultaneously, the sensible heat of exhaust gas that enters the chamber evaporates the water in the droplets, forming a dry powder before the gas leaves the spray dryer. The exhaust gas from the system contains a mixture of reacted and unreacted particulate. Typically, baghouses employing Teflon-coated fiberglass bags (to minimize bag corrosion) are used to collect the precipitated particulates. In some applications, the captured particulate is recycled to improve efficiency.

The system is categorized as a “dry” system because the end product of the SO<sub>2</sub> conversion reaction is a dry material. Although termed as a dry system, this air pollution device uses water for evaporative cooling for the SO<sub>2</sub> reaction. Unlike a wet scrubbing system, however, there is no liquid blow-down stream from the dry system. The “dry” system has been used in low-sulfur coal applications to effectively remove SO<sub>2</sub>. This control technology is technically feasible for the waste gas stream.

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### Dry Sorbent Injection:

Limestone injection has been a proven technology when applied to boilers. SO<sub>2</sub> may be removed by injecting a sorbent (lime, limestone, or dolomite) into the combustion gases, typically above the burners or in the backpass before the air heater. Furnace sorbent injection involves injection of the sorbent into the boiler above the combustion zone (preferably where the gas temperature is approximately 1,200 °C, or 2,200 °F) through special injection ports. The sorbent decomposes into lime, which reacts in suspension with SO<sub>2</sub> to form CaSO<sub>4</sub>. The CaSO<sub>4</sub>, unreacted sorbent, and fly ash are removed at the particulate control device (either an ESP or baghouse) downstream from the boiler. In boilers, SO<sub>2</sub> removal is 30 – 60% (with a calcium-to-sulfur molar ratio of 2:1) when injected into the combustion zone, but this still must be demonstrated on a large scale.

### Low-sulfur coal:

A method to reduce SO<sub>2</sub> emissions from fossil fuel combustion is to change to low-sulfur fuels. Stoichiometrically, 2 lb of SO<sub>2</sub> are generated by 1 lb of sulfur in a typical combustion process (i.e., utility boiler). Thus, reducing the sulfur content of the fuel proportionally decreases the generation of SO<sub>2</sub>. For example, replacing a coal containing 2% sulfur with a coal containing 1% sulfur (i.e., low-sulfur coal) results in a 50% decrease of SO<sub>2</sub> emissions.

The conversion of coal to coke however, may not directly parallel a boiler when it comes to low-sulfur fuels. Unlike coal-fired boilers, the coal is heated, not burned, during the coking process, and primarily it is the volatilized material from the coal that is combusted. Although most of the sulfur in the coal remains in the coke, the sulfur component of the volatilized material will produce SO<sub>2</sub>.

### ***RBLC Listings for SO<sub>2</sub> Emissions from Coke Oven Gas***

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
FDS Coke	OH-0297	Coke Oven Batteries	Lime Spray Dryer, Low Sulfur Coal, Combustion Optimization	91%	243.3 1019.0	lb/hr t/yr
Haverhill North Coke Co.	OH-0272	Coke Battery Ovens	Dry Scrubber, Lime Spray Dryer, and Low Sulfur Coal <1%	92%	265.0 0.88	lb/hr, 3hr avg. lb/ton of coal
Haverhill North Coke Co.	OH-0305	Coke Oven Batteries	Dry Scrubber with wet lime spray injection and low sulfur coal <1%	92%	192.0 700.8 1.6	lb/hr t/yr lb/ton coal

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

### **Step 2 – Eliminate Technically Infeasible Options**

#### Wet Scrubber:

Wet scrubbing systems can potentially reach high levels of SO<sub>2</sub> removal. However, many applications carry disadvantages for using wet scrubbing techniques. There is a large water use requirement, as well as a large amount of wastewater to be treated. A high capital cost is

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associated with them because materials must be constructed from expensive alloys to resist corrosion, and the equipment required is massive. The large physical size requires a great deal of space for installation, and energy use is much higher than other technologies.

A practical issue associated with a wet scrubber system is the complexity of the system. Additional expertise is often needed in specifying, operating, and maintaining such a system, which is more like a chemical plant than a control device. The systems require more maintenance due to their complexity, and more personnel are required for their operation. A wet scrubbing system is not known to have ever been used for coke ovens and therefore has not been considered a demonstrated or technically feasible control technology for this application.

### Dry Sorbent Injection:

Limestone injection has been demonstrated on boilers where combustion takes place in a well defined and centralized zone, and a high degree of control can be applied to the combustion conditions. By the nature of the coke oven process, combustion of the coke oven gas will be dispersed among 280 individual coke ovens, with flue gases collected at ten vents. A system to meter and inject dry sorbent on this basis would be complex and extremely costly. Dry sorbent injection is not known to have ever been used for coke ovens and therefore has not been considered a demonstrated or technically feasible control technology for this application.

### **Step 3 – Rank Remaining Technically Feasible Control Options**

1. Lime Spray Dryer/Absorber (Dry Scrubber) – 90%
2. Low-sulfur coal – 50%

The dry scrubber system has been used in low sulfur coal applications to effectively remove SO<sub>2</sub> from a gas stream with a removal efficiency of 90%. Wet scrubbers may be designed for efficiency of 80 – 95% SO<sub>2</sub> removal in boiler applications, yet require an enormous capital investment and produce disposal issue for other media.

### **Step 4 – Evaluate Remaining Control Technologies**

#### Lime Spray Dryer/Absorber (Dry Scrubber):

Spray drying systems have been frequently applied to coke ovens, and represent the industry standard for sulfur removal. A significant advantage of dry scrubbing is that it provides a high SO<sub>2</sub> removal efficiency without generating wastewater. Another advantage is that a spray dryer / baghouse system is a very effective particulate removal device.

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### **Low-sulfur Coal:**

The use of low sulfur coal in place of a more readily available and higher sulfur coal, often referred to as "fuel switching", has been a common method of sulfur control from boilers. However, the blast furnace process requires that sulfur reaching the pig iron product be at as low a level as possible, for metallurgical reasons of product quality. Coals used for metallurgical coke are typically restricted to coal with a sulfur content of 1.3% or less by weight. Therefore, low-sulfur coal technology is inherent in the coke oven process. However, while Nucor Steel Louisiana proposes to operate the coke ovens with the lowest sulfur coal practicable, coals with < 1 wt% sulfur are simply not available 100% of the time, due to market conditions.

The coke ovens at the proposed Nucor Steel Louisiana facility can receive coals from a number of different mines. These coals can be mixed and blended at the coal preparation area of the coke ovens (COK-100) to create compacted coal bricks with uniform properties. The selection of coals will be based on a large number of factors, including price, availability, transportation method and cost, and coal properties such as volatility, ash content, carbon content, moisture content, sulfur content, heating value, and softening temperature, among other properties. Optimization across all of these factors is key to the effective operation of the coke plant.

The control efficiency of SO<sub>2</sub> from lime spray towers is known to be dependent upon the concentration of SO<sub>2</sub> in the coke oven flue gas. At high concentrations of SO<sub>2</sub>, a lime scrubber can remove a higher percentage of SO<sub>2</sub> from the flue gas using the same molar ratio of lime to SO<sub>2</sub>. However, at low concentrations this efficiency falls off, and progressively higher ratios of lime to SO<sub>2</sub> must be used to obtain the same control efficiency. It may be favorable to use a low-sulfur blend for an extended period of time. In this situation, This could result in having difficulty in meeting a high control efficiency applied to a low concentration of SO<sub>2</sub>, creating a situation where compliance is difficult to achieve even though actual SO<sub>2</sub> emissions would be reduced over using a higher sulfur coal blend.

In light of the above, BACT for SO<sub>2</sub> from the coke oven flue gas stacks is:

1. No material charged to the coke ovens in excess of 1.3% sulfur by weight.
2. A six-month rolling average of sulfur content in the charge material to be recorded on a weekly basis.
3. When the average sulfur content of the charge material is less than 1.0%, a minimum SO<sub>2</sub> control efficiency of 90% would be required.
4. When the average sulfur content of the charge material is equal to or greater than 1.0%, a minimum SO<sub>2</sub> control efficiency of 91% would be required.

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### Step 5 – Selection of BACT

A top-down BACT analysis was performed for SO<sub>2</sub> removal from coke oven gas. A combination of low-sulfur coal and spray drying technologies will be applied to reduce SO<sub>2</sub> emissions from the coke ovens. A dry scrubber with removal efficiency no less than 90% was selected as BACT for SO<sub>2</sub> emissions. BACT is also selected as a maximum content of 1.3% sulfur in the coal.

The baghouse selected for PM<sub>10</sub> control, discussed above, will also control the dust generated by the spray dryer technology, providing a very effective use of resources. The combination of spray drying and low-sulfur coal has become an industry standard for SO<sub>2</sub> control from coke ovens.

### BACT analyses for CO and VOC

#### **Source ID – Description (EQT #)**

COK-111-Coke Battery 1 Flue Gas Desulfurization Stack (RLP006)

COK-211-Coke Battery 2 Flue Gas Desulfurization Stack (RLP012)

A discussion of CO and VOC controls is combined due to the similarity in approach for control of these emissions during the coking process and related activities. CO and VOC emissions are generated during the conversion of coal to coke and during pushing activities. The concentrations of CO and VOC are less than 5 ppm in the charging emissions.

### Step 1 – Identify Potential Control Technologies

#### Good Combustion Practices:

During the coking process, coal is heated and volatile matter is released from the coal bed. In the non-recovery coking process, coke oven gases are combusted within the coke oven sole flues in the oven walls and floor to provide the energy for heating the coal to produce coke. This approach naturally produces low emissions of CO and VOCs.

#### ***RBLC Listings for CO Emissions from Coke Oven Gas***

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
FDS Coke	OH-0297	Coke Oven Batteries	Combustion Optimization	NA	49.6 217.2	lb/hr t/yr
Haverhill North Coke Co.	OH-0272	Coke Battery Ovens	NA	NA	55.84 20.0	lb/hr ppm
Haverhill North Coke Co.	OH-0305	Coke Oven Batteries	Combustion Optimization	NA	21.81 95.54	lb/hr t/yr

Source: Technology Transfer Network Clean Air Technology Center - RACT/BACT/LAER Clearinghouse



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### *RBLC Listings for VOC Emissions from Coke Oven Gas*

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
FDS Coke	OH-0297	Coke Oven Batteries	Combustion Optimization	NA	10.6 46.5	lb/hr t/yr
Haverhill North Coke Company	OH-0272	Coke Battery Ovens	NA	NA	11.97 10.0	lb/hr ppm
Haverhill North Coke Company	OH-0305	Coke Oven Batteries	Combustion Optimization	NA	4.67 20.47	lb/hr t/yr

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

### **Step 2 – Eliminate Technically Infeasible Options**

The evaluation of these technologies must review whether the specific technology is available for the application and is effective at reducing CO and VOC emissions from the coking process. Good combustion is technically feasible for the treatment of coke oven gas.

### **Step 3 – Rank Remaining Technically Feasible Control Options**

The destruction of CO and VOCs is expected to be very high, as the non-recovery coke oven design acts to incinerate these compounds during a long residence time. This destruction is inherent to the non-recovery oven coking process, in which the coke oven volatiles are combusted under controlled conditions to provide the heat required for the coking process.

### **Step 4 – Evaluate Remaining Control Technologies**

During the process, the coke oven gas combustion in the sole flues naturally produces low emissions of CO and VOCs. The coke oven gas remains in the sole flues and common tunnel approximately seven seconds where the gases are exposed to oxidizing conditions and temperatures from 1,600 – 2,500 °F. These operating conditions can be compared to controlled-air incineration.

Controlled-air incineration combustion occurs in two stages. In the first stage, the low air-to-fuel ratio dries and facilitates volatilization of waste material, and most of the residual carbon burns. In the second stage, excess air is added to the volatile gases formed in the primary chamber to complete combustion. This type of system is recognized as state-of-the-art for destroying organic compounds and CO. Typical secondary chamber residence times are 0.5 seconds and range from 1,800 – 2,000 °F.

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### Step 5 – Selection of BACT

BACT is selected to be good combustion practices that promote complete combustion of volatile organic compounds and CO. BACT is selected as 0.0035 lbs of VOC per ton of coal charged – wet basis. BACT is selected as 0.06 lbs of CO per ton of coal charged – wet basis.

### BACT DETERMINATION FOR BLAST FURNACE & COKE OVEN COAL PREPARATION

#### BACT analyses for PM<sub>10</sub>

##### **Source ID – Description (EQT #)**

PCI-101 - PCI Mill Vent (RLP013)

COK-100 - Coke Ovens Coal Handling, Crushing, and Compacting (ARE001)

COK-104 - Coke Battery 1 Coke Handling (EQT004)

COK-204 - Coke Battery 2 Coke Handling (EQT010)

Pulverized coal is often injected along with the hot blast, to provide additional heating value. This technology increases the overall efficiency of the blast furnace operation. First, the coal is ground to a fine powder. The pulverized coal is stored under a controlled atmosphere, brought up to furnace pressure in feed tanks, and pneumatically conveyed to the blast furnace area.

In the coal preparation step, coal is crushed, screened and blended in order to produce a homogenous mixture for charging to the coke ovens. The mixture is then wetted to approximately 9% moisture by weight, loaded into a form, and compacted into a brick-like shape. The bricks are then transferred to charging cars for transportation to the individual ovens.

### Step 1 – Identify Potential Control Technologies

#### Crushing, Screening, and Blending

1. Enclosed conveyors
2. Water sprays and/or chemical dust suppression; and
3. Indoor crushing operations vented to fabric filters

The Table below provides the USEPA RBLC data for PM<sub>10</sub> controls for aggregate handling and storage operations. It is evident that the range of technologies cited above has been used as BACT for the various material handling operations. All of the above options are considered technically feasible.

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### ***RBLC Listings for PM<sub>10</sub> Emissions from Coal Preparation***

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
American Municipal Power	OH-0310	Coal Conveying, Handling, and Crushing	Baghouse with Option of Enclosures, Fogging, Wet Suppression	NA	9.0	t/yr
Louisiana Generating, LLC	LA-0223	Fuel Crusher House	Fabric Filters	NA	0.04 0.06	lb/hr t/yr
Western Farmers Electric Co-op – Hugo Generating Station	OK-0118	Material Handling	Fabric Filter Baghouse	NA	0.01	gr/dscf
Western Greenbrier CO-generation, LLC	WV-0024	Coal Handling	Fabric Filters	NA	0.01	gr/dscf
NRG Texas – NRG Coal Handling Plant	TX-0507	Crusher House, Transfer Tower 2, Silos A-D	Fabric Filter	NA	0.36	lb/hr
Lamar Utilities Board – Lamar Light & Power	CO-0055	Coal Handling and Preparation	High Efficiency Fabric Filter Baghouses	99.5%	0.02	Lb/ton

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

### **Step 2 – Eliminate Technically Infeasible Options**

All of the above mentioned technologies can be applied to control PM<sub>10</sub> emission sources due to coal processing. There are areas where water suppression may not be practical, such as areas that are enclosed. There are also areas where enclosures are not practical such as transporting, where water suppression might be a more effective means of controlling emissions.

### **Step 3 – Rank Remaining Technically Feasible Control Options**

1. Indoor crushing operations vented to fabric filters – 99%
2. Water sprays and/or chemical dust suppression – 90%
3. Enclosed Conveyors – 50%

### **Step 4 – Evaluate Remaining Control Technologies**

Local collection with fabric filter control demonstrates the highest degree of particulate control, and is an industry standard. Control efficiencies of 99% are attainable with a baghouse and enclosed processing area.

A search of the RBLC database indicates that a control efficiency of 90% can be achieved in areas where water suppression is applied. Water suppression is mainly used in storage piles areas. Dust suppression chemicals may not be used in areas where water suppression can achieve the same control efficiencies. Water suppression could be applied to the finished coal, and is indeed a necessary process step for the oven design.

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Enclosed conveyors help to prevent material from becoming airborne from wind passing across the conveyor. Estimated control efficiencies for enclosed conveyors are about 50%.

### **Step 5 – Selection of BACT**

BACT is selected to be a combination of control technologies for distinct steps in the process. Enclosures on the conveyors will be used to eliminate emissions from the conveyors during transfer operations. Coal crushing, screening and blending will be controlled by fabric filters. Wet suppression will be applied to the finished coal blend. BACT for coke handling operations using baghouses for control is selected as greater than or equal to 99.0 % removal efficiency from filter manufacturer's certification.

## **BACT DETERMINATION FOR COKE OVEN COAL CHARGING**

### **BACT analyses for PM<sub>10</sub>**

#### **Source ID – Description (EQT #)**

COK-101 - Coke Battery 1 Coal Charging (EQT001)

COK-201 - Coke Battery 2 Coal Charging (EQT007)

Charging is the process of adding coal to the ovens. In typical operations, the door is opened from one end of the oven and coal is charged using a horizontal ram. In this application, Nucor proposes to charge the oven with a compacted “brick” of coal instead of dumping “loose” coal into the oven as in older designs. An opening sized to the coal brick is opened in the charging door, and the coal brick is then moved on a charging bed into the coke oven by a horizontal ram, while a negative pressure is maintained on the oven. The charging bed is then retracted, sliding out from under the brick of coal. The emissions of particulate to the atmosphere are thereby minimized.

### **Step 1 – Identify Potential Control Technologies**

1. Fabric Filters (baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubbers
4. Cyclone
5. Negative Pressure Ovens
6. Compacted Coal

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### Negative Pressure Ovens:

Negative pressure ovens operate at a vacuum, minimizing the escape of particulate matter and gases as the oven doors are opened. The bricks of coal charged into the ovens are pushed in while stationary on a charging bed. The bed is then removed by sliding it out from under the coal. Thus, the potential to generate particulate emissions are minimized, and are selectively located in the negative pressure coke ovens.

### Compacted Coal:

Historical coke oven designs loaded loose, lump coal into the ovens, either by dumping the coal into the top of the oven from a larry car, or dropping it in by horizontal conveyor. These methods generate particulate emissions from the coal transfer steps. The coke oven design proposed by Nucor processes the coal prior to charging, such that it is wetted with water, mixed with a binding agent such as tar, and compressed into the shape of a large brick. The moisture, binder and cohesive shape of the brick minimize particulate emissions from coal charging by preventing the generation of these emissions. Additionally, there are fewer exposed coal transfer steps, such as the filling of a larry car, and subsequent dumping into the ovens, from an open location on top of the coke oven battery.

### ***RBLC Listings for PM<sub>10</sub> Emissions from Coke Oven Charging***

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Haverhill North Coke Company	OH-0305	Coke Oven Batteries	Baghouse with Traveling Hood	70%	1.17 Fugitive 4.36	lb/hr t/yr
Haverhill North Coke Company	OH-0272	Coke Battery Ovens	Baghouse with Traveling Hood	93%	1.2	lb/hr PM/PM10
Haverhill North Coke Company	OH-0272	Coke Battery Ovens	Baghouse with a shed extending the length of the battery capturing all emissions	98%	26.33 0.039	lb/hr lb/ton coal
FDS Coke	OH-0297	Coke Oven Batteries	Fabric Filter with Traveling Hood, Oven Negative Pressure	99%	0.32 1.0 0.008	lb/hr t/yr gr/dscf

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

## **Step 2 – Eliminate Technically Infeasible Options**

### Wet Scrubber:

Wet scrubbers collect particles by contacting or scrubbing gases with a liquid, usually water. To be effective on small particles, wet scrubbers must produce a high pressure drop and contain a large internal surface area. This typically requires a tall column coupled with a large blower motor. The length of travel required from end to end of the oven battery presents a problem in

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supplying power and water to the scrubber, and in collecting and routing the scrubber effluent to treatment. For these reasons, a wet scrubber is not technically feasible for coal oven charging PM<sub>10</sub> emissions.

### **Step 3 – Rank Remaining Technically Feasible Control Options**

1. Fabric Filter – 99%
2. Electrostatic Precipitator (ESP) – 98%
3. Cyclone – 80%
4. Negative Pressure Ovens – Prevention of Airborne Particles
5. Compacted Coal – Prevention of Airborne Particles

### **Step 4 – Evaluate Remaining Control Technologies**

#### **Fabric Filter (baghouse):**

Fabric filtration has been widely applied to industrial sources, including coal handling, since the early 1970s. Control efficiencies of fabric filters (baghouses) can easily attain 99% of the particulate collected. Variability in overall control efficiencies associated with baghouses is due to the efficiency of the capture device (e.g. hood) used to route the air stream to the baghouse. Baghouses of modest size have been mounted to traveling hoods attached to charging cars, collecting from each car individually. However, a traveling hood does not allow for ideal collection efficiencies for Nucor's proposed coal charging design, because particulate emissions are minimized while the coal brick is on the charging car.

#### **Electrostatic Precipitator (ESP):**

ESP is a proven technology for a variety of coal combustion sources. Because of their modular design, ESPs, like baghouses, can be applied to a wide range of system sizes. ESP technology offers a control efficiency that is comparable to baghouses for some applications. The operating parameters that influence ESP performance include mass loading, particle size distribution, particulate electrical resistivity, and precipitator voltage and current. The resistivity of charging emissions from coking is not known. Data for ESPs applied to coal-fired sources show fractional collection efficiencies greater than 99% for fine (less than 0.1 micrometer) and coarse particles (greater than 10 micrometers). These data show a reduction in collection efficiency for particle diameters between 0.1 and 10 micrometers. Applied to coal charging, an ESP system would face similar challenges to baghouse filters, in that the collection efficiencies of traveling hoods are less than ideal in when applied to compacted coal charging. When compared only to a baghouse application, fabric filters offer slightly more effective control efficiency.

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### Cyclones:

Cyclones are seldom used as primary or sole dust collectors because of their low efficiency. While they can be used to remove coarse particles, fine particulates are not effectively removed. A practical use is as pre-cleaners for more efficient collectors.

### Negative Pressure Ovens:

The negative pressure oven design captures particulate emissions generated immediately adjacent to, and within the oven during charging. The door opening provides a small gap around the brick as it is charged. Particulates that are generated in the oven throat are captured by the oven gas collection system and removed in the flue gas baghouse. This technology is inherent in the design of the coke ovens like that being proposed at Nucor Steel Louisiana.

As a pollution prevention technology, assigning a specific control efficiency to negative pressure ovens is problematic. It is expected that this design meets the criteria for being an Inherently Lower Polluting Process or Practice, as described in Section IV.A.3 of USEPA's *New Source Review Workshop Manual* published in October, 1990. Negative pressure ovens have the potential to be more environmentally effective than add-on controls, due to greatly reduced energy requirements and reduced handling steps of captured particulate.

### Compacted Coal:

Compact coal charging is a process method which helps to prevent the generation of particulate emissions from occurring. This practice begins by bringing the moisture content of the coal up to approximately 9 wt%. This reduces the potential for dust emissions when compared with the dried coal typically charged to coke ovens. The wetted coal is metered in layers into a large metal form, and then compacted by large hydraulic presses. The compaction process produces a cohesive brick of coal very close to the size and shape of the coke oven, which is then transferred to a charging car for use in the process.

As a pollution prevention technology, assigning a specific control efficiency to compacted coal charging is problematic. It is expected that this practice meets the criteria for being an Inherently Lower Polluting Process or Practice, as described in Section IV.A.3 of USEPA's *New Source Review Workshop Manual* published in October, 1990. Compacted coal charging has the potential to be more environmentally effective than add-on controls, due to greatly reduced energy requirements and greatly reduced quantities of particulate.

## Step 5 – Selection of BACT

A top-down BACT analysis was performed for the coal charging operations, and the combination

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of negative pressure ovens and compacted coal charging, which represent Inherently Lower Polluting Processes, were selected as BACT. It is expected that compacted coal charging technology will meet the MACT emission limitation of 0.0081 lb/ton of dry coal charged, required under 40 CFR 63.303(d)(2). Thus, BACT will not be less stringent than MACT.

### BACT DETERMINATION FOR COKE OVEN PUSHING

Pushing is the process of moving the coke out of the oven. Flat car pushing will be used to remove the coke from the oven at the end of the coking cycle. Flat car pushing is different than pushing from a typical byproduct coke oven battery. With flat car pushing, the still-cohesive coke bed is pushed onto a flat receiving car. When a byproduct coke oven is pushed, the loose coke bed falls into a receiving car breaking apart the mass of coke, with the potential to generate large plumes of dust. The advantage of flat car pushing, as feasible with a heat recovery coke oven, is that the mass of coke in the oven stays intact and a large dust plume is not generated.

#### BACT analyses for PM<sub>10</sub>

##### **Source ID – Description (EQT #)**

COK-102 - Coke Battery 1 Coke Pushing (EQT002)

COK-202 - Coke Battery 2 Coke Pushing (EQT008)

Flat car pushing will be used to remove the coke from the oven at the end of the cycle. Flat car pushing is different than conventional pushing. With conventional pushing, the coke bed falls into a hot car where it breaks apart and produces a large, hot plume of dust. The plume may be collected by either a mobile shed or by a large stationary coke-side shed. With flat car pushing, the coke bed is pushed onto a flat car as a cohesive mass. The car then travels by rail to the coke quench tower. The coke bed will be transferred, intact, to a quench car and quenched with contact cooling water in a conventional wet quench tower. The advantage of flat car pushing is that the coke bed stays intact and there is no large thermal dust plume.

Worker safety is also improved in several ways with the flat car push. With flat car pushing, visibility is improved since operators are not working inside a dark shed. With a zero fall height, operators do not have to work on an elevated bench. Without the large thermal plume, operators are less exposed to emissions and heat.

The air pollution control method used for flat car pushing must be chosen with two considerations. The coke bed is approximately 2,000 °F, and so the gases exiting the hood are normally extremely hot. Second, any add-on system must be short enough to pass below the hot ducts of the heat recovery system, and narrow enough to fit on a rail car.



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The air pollution control technology must also meet the PM<sub>10</sub> emission limitation set forth in the MACT for Pushing, Quenching, and Battery Stacks (40 CFR 63, Subpart CCCCC). The limit is 0.04 lb PM/ton coke for filterable PM, that equates to 0.08 lb total (filterable and condensable) PM, if a mobile control device that captures emissions during travel to the quench tower is used.

### Step 1 – Identify Potential Control Technologies

1. Fabric Filter (baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubber
4. Cyclone
5. Flat Car Pushing

#### Flat Car Pushing:

Using the flat car pushing process, the coke bed is pushed from the oven as a cohesive mass, resulting in greatly reduced particulate emissions when compared to traditional methods. With conventional pushing, the loose coke bed tumbles into a pile in a hot car, where it produces a large, hot plume of dust as it falls and breaks apart. Therefore, traditional control methods focus on the collection and removal of particulate from the pushing plume. With flat car pushing, the coke bed will be transferred, intact, to a quench car. The advantage of flat car pushing is that the coke bed stays intact and does not generate the large thermal dust plume typical of traditional coke oven pushing processes.

#### ***RBLC Listings for PM<sub>10</sub> Emissions from Coke Oven Pushing***

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Haverhill North Coke Company	OH-0305	Coke Oven Batteries	Multiclone Dust Collector	80%	13.72 12.53	lb/hr t/yr
Haverhill North Coke Company	OH-0272	Coke Battery Ovens	Baghouse with a shed extending the length of the battery capturing all emissions	98%	26.33 0.039	lb/hr lb/t
FDS Coke	OH-0297	Coke Oven Batteries	Fabric Filter with traveling hood, oven negative pressure, flat bed pushing	NA	2.1 6.3	lb/hr t/yr

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

### Step 2 – Eliminate Technically Infeasible Options

#### Electrostatic Precipitator (ESP):

An ESP charges particles in a gas stream so that they are attracted to, and collected by, neutral or oppositely charged collector plates. A major factor in the performance of an ESP is resistivity of the particles, which must be within a certain range. With high resistivity, it is difficult to charge

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the particles. With low resistivity, the particles are not held tightly to the collector plates and re-entrainment can be severe. Resistivity is strongly affected by temperature, moisture, gas composition, particle composition, and surface characteristics. The resistivity of pushing emissions from coking is not known.

High temperatures are not as much of an obstacle with ESPs as with baghouses since ESPs are usually constructed out of metal. As with baghouses, ESPs are typically large because the gas stream velocity traveling through the ESP must be low enough to avoid re-entrainment. Another difficulty is designing a system that is physically short enough to pass below the hot ducts, narrow enough to fit on a rail car, and mobile. An ESP is not a technically feasible choice.

### Wet Scrubber:

Wet scrubbers collect particles by contacting or scrubbing gases with a liquid, usually aqueous. To be effective on small particles, wet scrubbers must produce a high pressure drop. This would require a large motor. The design of a non-recovery coke oven battery prevents mounting and supplying power to such a large motor on the hot car track.

With wet scrubber systems, handling and disposal of the collected wet sludge is necessary. Use of a wet scrubber would not only require a wastewater treatment system but would add a wastewater discharge. Other concerns include the effect on materials and worker safety from the low level release of a hot saturated steam plume. Therefore, a wet scrubber is not technically feasible for coke oven pushing operations.

### **Step 3 – Rank Remaining Technically Feasible Control Options**

1. Flat car pushing – Prevention of Airborne Particles
2. Fabric Filter (baghouse) – 98%
3. Cyclone – 80%

### **Step 4 – Evaluate Remaining Control Technologies**

#### Flat Car Pushing:

Flat car pushing acts to prevent the creation of coke pushing plumes, by moving the coke as a cohesive mass rather than allowing it to tumble into a pile. As a pollution prevention technology, assigning a specific control efficiency to flat car pushing is problematic. However, this practice meets the criteria for being an Inherently Lower Polluting Process or Practice, as described in Section IV.A.3 of USEPA's *New Source Review Workshop Manual* published in October, 1990. Flat car pushing has the potential to be more environmentally effective than add-on controls, due to greatly reduced energy requirements and greatly reduced quantities of particulate, which are not generated to require control.

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### Fabric Filters (baghouse):

A fabric filter removes dust by passing the gas stream through a porous fabric. Many natural and synthetic fabrics are used to form the filter bags. Most baghouses used to control pushing emissions use polyester bags. Polyester bags have a temperature limit of approximately 275 °F. The fabrics most often used for high-temperature applications are Teflon, Nomex, carbon fibers, and fiberglass. Fiberglass can be used at temperatures up to 500 °F. Ceramic and metal filters have been used in a few high-temperature specialty applications, but with the large surface area needed for this type of application, they are not practical. A baghouse system could be designed to cool the gases to 500 °F. However, even a short temperature excursion would destroy the bags.

Baghouses are typically large air pollution control devices because, in order to work effectively, the velocity at the fabric face must be orders of magnitude slower than in the ductwork conveying the gases to the baghouse. Another consideration is that, since the hot car and its air pollution control device will travel to the quench tower, it will periodically catch water droplets and steam that typically causes bag blinding. The capture efficiency of a mobile hood is not considered to be ideal. Another obstacle is the difficulty in designing a baghouse system that is physically short enough to pass below the hot ducts, narrow enough to fit on a rail car, and mobile. With the gas temperature and size constraints, a baghouse is not an ideal control for coke oven pushing emissions.

### Cyclones:

Cyclones use inertial separation to remove particles from gas streams. Large cyclones are generally not very efficient on small particles because the inertial force is inversely proportional to the diameter, or turning radius, of the device. Cyclones are optimized for high collection efficiency by using small diameters, long cylinders, and high inlet velocities. A number of small cyclones may be operated in parallel for high efficiency and large gas volumes. These are referred to as multi-tube cyclones, or multiclones. High temperatures are not as much of an obstacle with mechanical collectors since they are typically constructed out of metal. However, the capture efficiency of a mobile hood is not considered to be ideal. Multiclones can also tolerate moist gas streams. Since the individual cyclones are small, a multicclone can be configured to meet the size criteria of the battery.

### **Step 5 – Selection of BACT**

A top-down BACT analysis was performed for PM<sub>10</sub> emissions from coke oven pushing operations. BACT is selected to be flat car pushing, which represents an Inherently Lower Polluting Process. It is expected that flat car pushing technology will meet the MACT emission limitation of 0.04 lb of filterable PM<sub>10</sub> per ton of coke pushed (0.08 lb PM<sub>10</sub>/ton coke total PM<sub>10</sub>), required under 40 CFR 63.7290. Thus, BACT will not be less stringent than MACT.

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### **BACT analyses for SO<sub>2</sub>**

#### **Source ID – Description (EQT #)**

COK-102 - Coke Battery 1 Coal Pushing (EQT002)

COK-202 - Coke Battery 2 Coal Pushing (EQT008)

BACT is selected to be compacted coal and flat car pushing, which represents an Inherently Lower Polluting Process. BACT is selected to be 0.098lbs SO<sub>2</sub> /ton.

### **BACT analyses for NO<sub>x</sub>**

#### **Source ID – Description (EQT #)**

COK-102 - Coke Battery 1 Coal Pushing (EQT002)

COK-202 - Coke Battery 2 Coal Pushing (EQT008)

BACT is selected to be compacted coal and flat car pushing, which represents an Inherently Lower Polluting Process. BACT is selected to be 0.019lbs NO<sub>x</sub> /ton.

### **BACT analyses for CO**

#### **Source ID – Description (EQT #)**

COK-102 - Coke Battery 1 Coal Pushing (EQT002)

COK-202 - Coke Battery 2 Coal Pushing (EQT008)

BACT is selected to be compacted coal and flat car pushing, which represents an Inherently Lower Polluting Process. BACT is selected to be 0.0638lbs CO /ton.

### **BACT analyses for VOC**

#### **Source ID – Description (EQT #)**

COK-102 - Coke Battery 1 Coal Pushing (EQT002)

COK-202 - Coke Battery 2 Coal Pushing (EQT008)

BACT is selected to be compacted coal and flat car pushing, which represents an Inherently Lower Polluting Process. BACT is selected to be 0.077lbs VOC /ton.

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### BACT DETERMINATION FOR COKE QUENCHING

#### BACT analyses for PM<sub>10</sub>

##### **Source ID – Description (EQT #)**

COK-103 - Coke Battery 1 Coke Quench Tower (EQT003)

COK-203 - Coke Battery 2 Coke Quench Tower (EQT009)

The coke pushed from the coke ovens remains at a very high temperature, as high as 2,000 °F. The coke must be quenched before it can be processed and transported for use. The quenching process involves contacting the brick of coke with controlled sprays of cooling water. The hot air and steam evolved from quenching are funneled through a large chimney structure known as a coke quench tower.

#### **Step 1 – Identify All Control Technologies**

1. Quench tower with internal baffles
2. Low-Total Dissolved Solids (TDS) cooling water

#### Quench Tower with Internal Baffles:

A coke quench tower draws hot air and steam by natural convection, much like a chimney. By installing a series of baffles to slow and contort the air flow, quench towers help to stop steam and entrained particles from exiting the top of the tower. The quenching steam and particles drain down the interior walls of the tower as the steam condenses.

#### Low TDS Cooling Water:

By maintaining a low level of total dissolved solids in the cooling water, the amount of particulate matter generated by the steam drift can be greatly reduced. A TDS concentration of 1,100 ppm or less is typically considered to be a low concentration in cooling water.

#### ***RBLC Listings for PM<sub>10</sub> Emissions from Coke Quench Towers***

Facility	RBL C ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Sun Coke Company – Haverhill North Coke Company	OH-0305	Quench Towers (2)	Quench Towers	N/A	24	lb/hr (per tower)
Sun Coke Company – Haverhill North Coke Company	OH-0272	Quench Tower (6)	Low-TDS Quenching Water	N/A	1,100	mg/L (Max TDS)
U.S. Coking Group LLC, FDS Coke	OH-0297	Quenching Towers	Internal Baffles	NA	16.82	lb/hr (per tower)

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

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### **Step 2 – Eliminate Technically Infeasible Options**

The evaluation of these technologies must review whether the specific technology is available for the application and is effective at reducing PM<sub>10</sub> emissions from the quench towers. BACT will be chosen as the most efficient and economical option. There are no technically infeasible options that were identified for the control of PM<sub>10</sub> from coke quenching.

### **Step 3 – Rank Remaining Technically Feasible Control Options**

1. Low TDS cooling water
2. Drift eliminators

#### Low TDS Cooling Water:

By reducing the TDS concentration to less than 1,100 ppm, the generation of particulate can typically be prevented to a high degree. Low TDS quenching water is obtained by installing good water quality control processes, such as settling tanks, filtration and water treatment chemicals.

#### Quench Towers with Internal Baffles:

Baffles provide a structural method of reducing the steam plume generated during quenching, thus reducing the amount of particulate which escapes the quench tower.

### **Step 4 – Evaluate Remaining Control Technologies**

Due to their nature as pollution prevention controls, specific control efficiencies cannot be applied directly to either low TDS cooling water or to quench towers with internal baffles. However, these methods represent current industry standards for the control of particulate emissions from coke quenching operations. Additionally, low TDS cooling water is required by an applicable NESHAP and must therefore be considered a floor in establishing BACT.

### **Step 5 – Selection of BACT**

A top-down BACT analysis was performed for PM<sub>10</sub> control from cooling towers. Both remaining options are effective and technically achievable. Therefore, BACT is selected to be a combination of less than or equal to 1,100 milligrams per liter TDS concentration in the cooling water, and quench towers with internal baffles. This technology will meet the MACT emission limitation of  $\leq 1,100$  milligrams per liter TDS concentration), required under 40 CFR 63.7295(a)(1)(i). Thus, BACT will not be less stringent than MACT.

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### BACT DETERMINATION FOR SLAG GRANULATION / PROCESSING AND MILLING

#### BACT analyses for PM<sub>10</sub>

##### **Source ID – Description (EQT #)**

SLG-101 - Slag Granulator 1 Granulation Tank 1 (EQT036) [WS]

SLG-102 - Slag Granulator 1 Granulation Tank 2 (EQT037) [WS]

SLG-201 - Slag Granulator 2 Granulation Tank 1 (EQT038) [WS]

SLG-202 - Slag Granulator 2 Granulation Tank 2 (EQT039) [WS]

SLG-301 - Air-Cooled Slag Processing Load Bin (EQT040) [WS]

SLG-302 - Air-Cooled Slag Processing Primary Crusher (EQT041) [WS]

SLG-303 - Air-Cooled Slag Processing Primary Screening (EQT042) [WS]

SLG-304 - Air-Cooled Slag Processing Secondary Crusher (EQT043) [WS]

SLG-305 - Air-Cooled Slag Processing Secondary Screen (EQT044) [WS]

SLG-306 - Air-Cooled Slag Processing Stockpiles (ARE011) [WS]

SLG-401 - Slag Mill Wet Slag Feed Bin (EQT045) [WS]

SLG-402 - Slag Mill Dryer Stack (RLP014) [FF]

SLG-403 - Slag Mill Dryer Baghouse Vent (EQT046) [FF]

SLG-404 - Slag Mill Dry Slag Feed Bin Baghouse Vent (EQT047) [FF]

SLG-405 - Slag Mill Crushers/Screeners Baghouse Vent (EQT048) [FF]

SLG-406 - Slag Mill Building Baghouse Vent (EQT049) [FF]

SLG-407 - Slag Mill Transfer Points Baghouse Vent (EQT050) [FF]

SLG-408 - Slag Mill Product Silo Baghouse Vent (EQT051) [FF]

SLG-409 - Slag Mill Loading Collector Baghouse Vent (EQT052) [FF]

**Normal Operation:** (For Diverted slag see section titled Diverted Air Cooled Slag)

Molten slag is rapidly cooled and granulated by high pressure water jets while falling freely from the end of the blast furnace slag runner. The slag/water mixture falls into a granulation chute and is directed into a granulator tank. The slag cooling process releases steam which rises and is discharged through a stack directly above the granulator tank.

The molten slag is cooled and granulated by high pressure water jets while falling from the end of the blast furnace slag runner. The slag/water mixture falls into a granulation chute and into a granulation tank. The slag/water mixture flows by gravity to a dewatering wheel. The granulated slag is then conveyed to storage piles.

A portion of the granulated slag is further processed into pulverized slag for specialty uses. The wet granulated slag is picked up by mechanical loader and loaded into a hopper at the dryer. The slag is dried and then fed to a mill in which the material is pulverized to a fine powder. The pulverized slag is conveyed to silos where it is stored for product loading. The pulverized slag is often mixed with, and used as a substitute for, portland cement.

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### Step 1 – Identify Potential Control Technologies

1. Fabric Filter (FF) (baghouse) – milling only
2. Electrostatic Precipitator (ESP)– milling only
3. Wet Scrubber– milling only
4. Cyclone– milling only
5. Water suppression (WS) – granulation, handling, and milling

#### Water Suppression:

Water spray onto the molten slag is an inherent part of the slag granulation process, and also functions to suppress particulate emissions. The granulated slag remains wetted following the dewatering step. The use of water suppression and chemical surfactants can control PM<sub>10</sub> emissions by up to 90%.

Each of these technologies is considered viable alternatives to controlling PM<sub>10</sub> emissions from the slag milling process. The slag granulation process includes water suppression as part of the means of granulation of the slag. The slag granulation process also involves wetted material handling as part of the inherent process as well.

The slag milling process produces a dry powder product, pulverized slag. The pulverized slag is cementitious, and as such contact with water destroys product quality. Due to the nature of the product, water suppression is not a feasible control option for slag milling.

The following table displays which control technologies are being used in the United States to control PM<sub>10</sub> emissions from slag granulation.

***RBLC Listings for PM<sub>10</sub> Emissions from Slag Granulation / Processing and Milling***

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Nucor Steel, Arkansas	AR-0090	Slag Processing	Water Sprays	NA	1.5 2.2	lb/hr t/yr
Steel Dynamics, Inc.	IN-0079	Slag, Handling and Processing	Water Suppression and Minimizing Drop Heights	NA	55.4	lb/hr
Charter Manufacturing Co. Inc.	OH-0276	Slag Processing Operation	Enclosure Where Practical	NA	0.79 0.56	lb/hr t/yr
Nucor Yamato Steel	AR-0055	Slag Processing	Wet Suppression	80%	1.2	lb/hr
Arkansas Steel Associates	AR-0044	Slag Processing	Water Application to Control Fugitive Emissions	.	5.7 8.3	lb/hr t/yr
Quanex Corporation-Macsteel Div.	AR-0021	Slag Processing	Throughput Limit on Slag, Water Sprays on Transfer Points	70%	3.8	t/yr



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Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
SteelCorr, Inc.	AR-0077	Slag/Mill Processing	Water Application and Limited Drop Heights		3.5	t/yr
Recmix of PA, Inc.	KY-0095	Raw Slag Handling	Watering	90%	0.78	t/yr
Recmix of PA, Inc.	KY-0095	Raw Slag Handling, Hopper	Enclosure Tunnel	90%	0.78	t/yr
Recmix of PA, Inc.	KY-0095	Slag Skull Processing	Watering, High Moisture Content	90%	0.78	t/yr
Structural Metals, Inc.	TX-0445	Slag Crusher-Transfer to Feeder	NA	NA	0.0544 0.0248	lb/hr t/yr
Structural Metals, Inc.	TX-0445	Slag Crusher-Jaw Crusher	NA	NA	0.005 0.0009	lb/hr t/yr
Structural Metals, Inc.	TX-0445	Slag Crusher Discharge	NA	NA	0.128 0.0052	lb/hr t/yr

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

### Step 2 – Eliminate Technically Infeasible Options

Each control technology was evaluated to decide whether it would be technically feasible to apply the control to the slag granulation / processing or milling processes. The evaluation for these particulate control technologies must review whether the specific technology is available for the application and is effective at reducing PM<sub>10</sub> emissions from the process.

#### Fabric Filter (baghouse):

Fabric filters are an industry standard when applied to relatively dry gas streams, with a large range of acceptable particulate loading. Fabric filter control is achievable for the slag milling operations, where fine dusts are generated at stationary sources, allowing for good collection efficiencies.

However, baghouses are sensitive to temperature and moisture extremes. Moisture generated by steam of the slag granulation process would cause caking on the filter and clog passageways, rendering the filter ineffective. Fabric filters would also be applied in a post-control manner, because water suppression is inherent in the granulation process. Therefore, the increased moisture content makes fabric filters a technically infeasible control option for the slag granulation process.

#### Electrostatic Precipitator (ESP):

ESPs are capable of 98% or higher particulate removal; however several factors preclude their application to control PM<sub>10</sub> from the slag granulation process. ESPs have very high electricity

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demands and require large amounts of maintenance, resulting in a relatively high down time. In addition, ESPs have a high capital cost, and efficiency is highly sensitive to variations in flow rate, solids loading, pressure, temperature, and moisture that are inherent in the slag granulation processes.

ESPs are also sensitive to the physical characteristics of the gas stream. A key parameter is the composition of the particles to be collected. Iron particles adhere very strongly to the collection plate of the ESP due to their electromagnetic properties. They become very difficult to remove and thus reduce ESP efficiency.

ESPs are a technically infeasible control option the slag granulation process since the technology would be post-control. Water suppression control is inherent to the granulation process and handling of wet granulated slag.

ESP control of the slag milling process is technically feasible. However, compared only to the fabric filter control, the efficiency of ESP devices are slightly lower, and capital and operating costs are greatly increased. Baghouse control is typically preferred over ESP control absent factors which make fabric filters infeasible.

### Wet Scrubber:

With wet scrubber systems, handling and disposal of the collected wet sludge is necessary. Use of a wet scrubber would not only require a wastewater treatment system, but would also add the need for a wastewater discharge. Wet scrubbers are a technically infeasible control option for the slag granulation or slag processing processes since the technology would be post-control.

### Cyclone (Granulation only):

Although cyclones are generally not sensitive to the vapor-phase moisture content of a gas stream, they are generally not applicable to processes that entrain a constant amount of liquid moisture. Liquid water in a cyclone separator can interfere with the airflow within the cyclone, cause caking of the particulate against the sides of the vessel, and contribute to plugging of the dustcatcher bottom. The slag granulation process will generate a great deal of steam and mist, making the application of cyclone separators infeasible to the process.

### Water Suppression (Milling only):

Water suppression is inherent to the slag granulation and granulated slag handling processes. However, water reacts with pulverized slag in a manner similar to cement. Therefore, water suppression would destroy the pulverized powder that the milling process is engaged in producing. Water suppression is an infeasible technology for the slag milling process.

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### **Step 3 – Rank Remaining Technically Feasible Control Options**

1. Water Suppression – 90% (slag granulation and processing only)

Water suppression remains the most stringent control option that can be applied to the slag granulation and processing processes. Water suppression is also a feature inherent in the slag granulation process. It can be seen from the table above that a 90% efficiency can be achieved due to the material having a high moisture content.

1. Fabric Filter – 99% (slag milling only)
2. Electrostatic Precipitator (ESP) – 98% (slag milling only)
3. Cyclones – 80% (slag milling only)

Fabric filters are the most stringent control option that can be applied to the dried and milled granulated slag. Fabric filters operate at high control efficiencies for this material.

### **Step 4 – Evaluate Remaining Control Technologies**

#### Water Suppression (slag granulation only):

Water suppression has been used at a number of facilities around the country for controlling dust generation due to slag processing. Water suppression is an inherent part of the slag granulation process.

#### Fabric Filters (slag milling only):

Fabric filters are routinely used for dust control in the milling process. The milled granulated slag is a fine, dry material which is ideal for control by baghouses.

### **Step 5 – Selection of BACT**

BACT is selected to be wet suppression of dust generating sources (slag granulation) by water sprays. This technology is inherent to the granulated slag process.

BACT for the granulated slag milling process is selected as collection and control by fabric filters.

### **BACT DETERMINATION FOR DIVERTED AIR-COOLED SLAG**

Emissions associated with air-cooled slag processing include the generation of fugitive dust emissions during the diversion and air cooling of the slag. Slag that cannot be immediately

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processed is diverted into slag pits. The slag flows by gravity over a large area, cools, and hardens. A water mist may be applied to speed the cooling of the slag. Once the slag cools and hardens, it can be picked up in chunks by a mechanical loader. The slag chunks are then loaded into a crushing and screening operation, to produce an aggregate material of similar size as the granulated slag. The air-cooled slag is then combined with the granulated slag in storage piles.

### **BACT analyses for PM<sub>10</sub>**

#### **Source ID – Description (EQT #)**

SLG-104 - Blast Furnace 1 Slag Pit 1 (ARE005)

SLG-105 - Blast Furnace 1 Slag Pit 2 (ARE006)

SLG-106 - Blast Furnace 1 Slag Pit 3 (ARE007)

SLG-204 - Blast Furnace 2 Slag Pit 1 (ARE008)

SLG-205 - Blast Furnace 2 Slag Pit 2 (ARE009)

SLG-206 - Blast Furnace 2 Slag Pit 3 (ARE010)

The diverted slag flows by gravity over a large area, cools through contact with air, and solidifies. Once the slag hardens, it can be picked up in chunks by a mechanical loader. The air-cooled slag is then loaded into a crushing operation, which reduces the material size to that of aggregate. The crushed material is combined with the granulated slag, and the crushed/granulated material is sold primarily as a substitute for gravel aggregates in asphalt or concrete.

### **Step 1 – Identify Potential Control Technologies**

Water sprays and/or chemical dust suppression

It is evident that the technologies cited above have been used as BACT for the various aggregate handling operations. All of the above options are considered technically feasible.

#### ***RBLC Listings for PM<sub>10</sub> Emissions from Air-Cooled Slag Processing***

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Recmix of PA, Inc.	KY-0095	Conveyor to Stockpile	Watering	90%	0.78	t/yr
Recmix of PA, Inc.	KY-0095	Final Aggregate Handling, Exit Pile	High Moisture Content	90%	0.78	t/yr
Steel Dynamics, Inc	IN-0079	Slag, Handling and Processing	Water Suppression and Minimizing Drop Heights	NA	55.4	lb/hr

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

### **Step 2 – Eliminate Technically Infeasible Options**

All of the above mentioned technologies can be applied to control PM<sub>10</sub> emission sources due to aggregate handling.

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### **Step 3 – Rank Remaining Technically Feasible Control Options**

Water sprays – 90%

A search of the RBLC database indicates that a control efficiency of 90% can be achieved in areas where water suppression is applied.

### **Step 4 – Evaluate Remaining Control Technologies**

Water sprays are effective at controlling dusts by weighing down the dust particles. Water sprays are generally used in local areas such as load bins and drop points when dealing with dusty materials.

### **Step 5 – Selection of BACT**

BACT is determined to be wet suppression of dust generating sources by water sprays at the slag pits after air cooling and prior to removal by a mechanical loader.

### **BACT DETERMINATION FOR TOPGAS-FIRED BOILERS**

Blast furnace gas (BFG), is utilized as fuel gas in the topgas boilers, along with a small amount of natural gas utilized to increase the BTU content of the fired gas to a stable combustion range. The blast furnace is discussed in detail above.

A portion of the BFG stream is used as a fuel in the hot blast stoves and a larger portion is used as fuel in the topgas boilers. BFG contains as much as 7 percent hydrogen and 27 percent CO, and has a heating value of approximately 2,540 - 4,300 kJ/Nm (65 - 110 Btu/scf).

Use of the BFG as a fuel in the topgas boilers significantly increases the overall energy efficiency of the pig iron production process. BFG is used to fire boilers that sequentially drive steam turbines to generate electricity and steam for facility processes. The remaining energy of the low-BTU BFG is used as fuel instead of being vented, which would result in high CO emissions, or being discarded in a thermal oxidizer or flare to control CO emissions, as in older blast furnace designs.

#### **BACT analyses for PM<sub>10</sub>**

##### **Source ID – Description (EQT #)**

PWR-101 - Topgas Boiler No. 1 (EQT023)

PWR-102 - Topgas Boiler No. 2 (EQT024)

PWR-103 - Topgas Boiler No. 3 (EQT025)

PWR-104 - Topgas Boiler No. 4 (EQT026)

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PWR-105 - Topgas Boiler No. 5 (EQT027)

PWR-106 - Topgas Boiler No. 6 (EQT028)

PWR-107 - Topgas Boiler No. 7 (EQT029)

PWR-108 - Topgas Boiler No. 8 (EQT030)

The blast furnace gas contains incombustible particulate matter in the stream as it leaves the blast furnace. Therefore, the control of particulate from the topgas boilers addresses the cleaning of the BFG prior to its combustion as a fuel.

### **Step 1 – Identify Potential Control Technologies**

1. Fabric filter (baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet scrubber
4. Cyclone
5. Good combustion practices

#### Good Combustion Practices:

Good combustion practices are used in areas where it is difficult to feasibly implement other control technologies. PM<sub>10</sub> emissions from natural gas combustions are usually from large-molecular-weight hydrocarbons that are not fully combusted. Condensable organic PM<sub>10</sub> can be best controlled through good combustion practices. Inorganic particulate inherent in the fuel gas stream cannot be controlled by good combustion practices.

### **Step 2 – Eliminate Technically Infeasible Options**

#### Electrostatic Precipitator (ESP):

ESPs are capable of 99% or higher particulate removal; however several factors preclude their application to control PM<sub>10</sub> from the topgas boilers. ESPs have a high capital cost, have very high electricity demands and require large amounts of maintenance, resulting in a relatively high down time. In addition, the efficiency of an ESP is highly sensitive to variations in flow rate, solids loading, pressure, and temperature, variations that are inherent in the blast furnace process.

ESPs are also sensitive to the composition and physical characteristics of the particles to be collected in the gas stream. Iron particles adhere very strongly to the collection plate of the ESP due to their electromagnetic properties. They become very difficult to remove, and thus rapidly reduce ESP efficiency. Zinc and other metal compounds tend to foul ESP electrodes, also reducing effectiveness. ESPs have long been considered a technically infeasible control option for this source.

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### **Fabric Filter (baghouse):**

Fabric filters are the standard in the iron and steel industry for most PM<sub>10</sub> control applications. Baghouses often are capable of 99% removal efficiencies. Baghouse removal efficiency is relatively level across the particle size range. However, the nature of the particulate being removed and the high moisture content of the gas exiting the blast furnace make the particulate difficult to remove from the fabric filter during the bag cleaning cycle, and dust build up occurs on the exterior of the bags. Dust build up results in plugging and eventual ruining of the fabric filters on an overly frequent basis, making baghouses a technically infeasible option.

### **Step 3 – Rank Remaining Technically Feasible Control Options**

1. Cyclone and Wet Scrubber Combination - 99%
2. Wet Scrubber - 98%
3. Cyclone - 80%
4. Good Combustion Practices

Potential control alternatives were reviewed for technical feasibility in controlling PM<sub>10</sub> emissions from the pig iron production facility. The highest remaining control option is a combination of cyclone separator followed by a wet scrubber. PM<sub>10</sub> emissions can be reduced by up to 99% with the addition of a cyclone and wet scrubber combination.

### **Step 4 – Evaluate Remaining Control Technologies**

#### **Combined Cyclone and Wet Scrubber:**

The prevalent industry control for blast furnace top gas is a multi-stage cleaning operation. In the multi-stage cleaning operation, blast furnace top gas passes first through a dry cyclone to remove the large particulate and a large percentage of the total particulate (about 60%). The cyclone step is followed by a high efficiency wet scrubber system. The combined controls are capable of achieving a 99% reduction in total particulate matter.

#### **Wet Scrubber:**

High-energy wet scrubbers are technically feasible but have some disadvantages. Scrubber systems have very high pressure drops that result in high system operating costs. They also require water treatment and sludge disposal, which are not necessary with the other PM<sub>10</sub> control options. However, wet scrubbers are able to accommodate large volumes of gas with high moisture contents, which make it a viable option for this application.

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### Cyclones:

Cyclones are effective at removing large dust particles using centrifugal forces. However, fine dusts are typically not as effectively removed, due to the high gas stream velocity must be established, often keeping smaller particles entrained in the stream. A cyclone would achieve greater efficiency if used in combination with another control technology.

### Good combustion practices:

While condensable organic PM<sub>10</sub> can be controlled through good combustion practices, dusts from metal ores in the fuel gas stream are typically not able to be fully combusted. Filterable particulate emissions generated from gas combustion are low. Particulate from gas combustion is usually from large-molecular-weight hydrocarbons in the fuel that are not fully combusted. These hydrocarbons do not exist in blast furnace gas, and exist at very low concentration in natural gas. Good combustion practices are limited as a control technology for BFG combustion.

### **Step 5 – Selection of BACT**

Based on the top-down BACT analysis, the best available control technology includes a cyclone followed by a wet scrubber. A cyclone will remove coarser particulate that may be difficult for the scrubber to remove on its own, and will not typically be affected by high moisture content in the gas stream. A wet scrubber can accommodate the large volumes of moist gas which are generated by the blast furnace process. Together, these two options provide the most viable scenario for PM<sub>10</sub> emissions control, by cleaning the blast furnace gas fuel stream prior to combustion. BACT for the blast furnace top gas fuel stream is established as a concentration of PM  $\leq$  0.002 gr/dscf.

### **BACT DETERMINATION FOR NO<sub>x</sub> EMISSIONS FROM TOPGAS-FIRED BOILERS**

The topgas boilers are a NO<sub>x</sub> emissions concern because they consume large quantities of fuel. NO<sub>x</sub> formation is often driven by, among other factors, high flame temperatures during combustion. However, the primary fuel is blast furnace gas, which is largely CO, has a low heating value, and contains a large portion of inerts (approximately 65 wt%), factors that reduce flame temperature. Thus, the generation of NO<sub>x</sub> during BFG combustion results in uncontrolled NO<sub>x</sub> concentrations in the flue gas that tend to be low (27 ppmv or less according to literature sources), and thus the potential for NO<sub>x</sub> reduction is considered to be small.

Use of the BFG as a fuel significantly increases the overall energy efficiency of the blast furnace, since less fossil fuel is used to power the facility, and the low-BTU BFG is used as fuel instead of being vented to the atmosphere (resulting in high CO emissions), or burned in a thermal oxidizer or flare to control CO emissions, wasting the remaining available energy in the gas.



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### **BACT analyses for NO<sub>x</sub>**

#### **Source ID – Description (EQT #)**

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PWR-102 - Topgas Boiler No. 2 (EQT024)

PWR-103 - Topgas Boiler No. 3 (EQT025)

PWR-104 - Topgas Boiler No. 4 (EQT026)

PWR-105 - Topgas Boiler No. 5 (EQT027)

PWR-106 - Topgas Boiler No. 6 (EQT028)

PWR-107 - Topgas Boiler No. 7 (EQT029)

PWR-108 - Topgas Boiler No. 8 (EQT030)

### **Step 1 – Identify Potential Control Technologies**

1. Selective Catalytic Reduction (SCR)
2. Selective Non-catalytic Reduction (SNCR)
3. Non-Selective Catalytic Reduction (NSCR)
4. EM<sub>x</sub> (SCONO<sub>x</sub>)
5. Low Excess Air (LEA) combustion
6. Low NO<sub>x</sub> Burners (LNB)
7. Low NO<sub>x</sub> Fuel Combustion (LNC)

### **Step 2 – Eliminate Technically Infeasible Options**

The evaluation of these technologies must review whether the specific technology is available for the application and is effective at reducing NO<sub>x</sub> emissions from the topgas boilers.

#### **Low Excess Air (LEA) combustion:**

Flame stability is an inherent problem with burning BFG fuel. Natural gas must be added to the BFG in order to increase the BTU content and obtain a stable flame. The nature of the BFG fuel and the high CO content make low excess air an infeasible option. There were no instances in literature sources of LEA use for boilers firing blast furnace gas.

#### **Selective Catalytic Reduction (SCR):**

Selective catalytic reduction has not been demonstrated to control emissions of NO<sub>x</sub> from boilers burning blast furnace gas as the primary fuel. The concentration of NO<sub>x</sub> in the topgas boiler flue gas is expected to be low, near 50 ppm under normal operating conditions. NO<sub>x</sub> control has not

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been demonstrated at high efficiency at this level of NO<sub>x</sub> concentration, and attempts at increased efficiency come with the probability of ammonia slip. Additionally, SCR would require that the boiler flue gas be reheated into the effective range of the catalyst, which is between 500 – 800 °F, by burning natural gas or some other fossil fuel. For these reasons, SCR is not a feasible control technology for the control of NO<sub>x</sub> from the topgas boilers.

### Selective Non-Catalytic Reduction (SNCR):

SNCR can only be effective when used in applications where the temperature of the gas stream is extraordinarily high, between 1,600 – 2,100 °F. Due to the low heating value of the blast furnace gas combusted in the hot blast stoves, the temperature of the flue gas never reaches temperatures in the effective range. Thus, SNCR is not a feasible control technology for the control of NO<sub>x</sub> from hot blast stoves.

### Non-Selective Catalytic Reduction (NSCR):

Non-selective catalytic reduction requires specific levels of several process parameters that are incompatible with the combustion of blast furnace gas in the topgas boilers. The low oxygen range required by NSCR can only be achieved by restricting the available combustion air to stoichiometric levels. As discussed for low excess air combustion, the low heating value of the blast gas does not allow for combustion at low levels of combustion air. Additionally, levels of NO<sub>x</sub> and VOC in the flue gas stream are not within the range necessary, and the flue gas temperature leaving the boilers will not reach the level required, to promote the catalytic reaction. Thus NSCR is not a feasible control technology for the control of CO from topgas boilers.

### EM<sub>x</sub> (SCONO<sub>x</sub>):

EM<sub>x</sub> technology uses catalyst beds with narrow, honeycomb structures, which expand and contract with temperature in a sensitive manner. These expansions and contractions must be allowed for with complex expansion joints. Large temperature swings during operation can render the system ineffective as pass-through leaks develop within the catalyst modules. The hot blast stoves will operate in a cyclic fashion, such that the flue gas leaving the stoves will experience regular temperature swings between 180 – 400 °C (356 – 752 °F). Due to its sensitivity to temperature changes, EM<sub>x</sub> is a technically infeasible control technology for the topgas boilers.

### Low NO<sub>x</sub> Burners (LNB):

Low NO<sub>x</sub> burners limit the formation of NO<sub>x</sub> by staging the addition of air to create a longer, cooler flame. The combustion of BFG in the topgas boilers requires the supplement of natural gas in order to maintain flame stability and prevent flame-outs of the burners. The use of low NO<sub>x</sub> burners would attempt to stage fuel gas at the limits of combustibility, and potentially prevent

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combustion of the fuel from occurring. Thus, Low NO<sub>x</sub> burners are not a feasible control technology for the topgas boilers.

### **Step 3 – Rank Remaining Technically Feasible Control Options**

The available control technologies were ranked according to their efficiencies. The efficiencies listed are in reference to natural gas combustion. No data was available for blast furnace gas combustion efficiency. Blast furnace gas is known to have a lower heating value than natural gas.

#### **1. Low-NO<sub>x</sub> Fuel Combustion (LNC) – 35% - 55%**

Standard BFG boilers are inherently designed to operate at reduced flame temperature that minimizes NO<sub>x</sub> formation, as a result of firing a low heating value primary fuel. There are no instances in literature where SCR or SNCR have been added to boilers firing blast furnace gas, and the technology has not been demonstrated in BFG boiler applications.

### **Step 4 – Evaluate Remaining Control Technologies**

Low-NO<sub>x</sub> fuel combustion is the only remaining NO<sub>x</sub> control technology. BFG burns at a lower temperature than natural gas or most other fuels, limiting the formation of thermal NO<sub>x</sub>. The generation of NO<sub>x</sub> from BFG combustion is expected to be 35 – 55% lower than the NO<sub>x</sub> generated by an equal energy consumption of natural gas.

### **Step 5 – Selection of BACT**

Using the top-down BACT selection method, the inherent low-NO<sub>x</sub> fuel combustion of BFG is the only remaining option for controlling NO<sub>x</sub> emissions from the topgas boilers. Additionally, a search of the RBLC produced no results for NO<sub>x</sub> emission add-on controls applied to boilers burning blast furnace gas in the United States. Therefore, BACT is selected to be no additional controls beyond the low-NO<sub>x</sub> fuel combustion technology inherent to the topgas boiler design. BACT is also established as 0.092 lbs/MM Btu total fuel combusted.

#### **BACT analyses for SO<sub>2</sub>**

##### **Source ID – Description (EQT #)**

PWR-101 - Topgas Boiler No. 1 (EQT023)

PWR-102 - Topgas Boiler No. 2 (EQT024)

PWR-103 - Topgas Boiler No. 3 (EQT025)

PWR-104 - Topgas Boiler No. 4 (EQT026)

PWR-105 - Topgas Boiler No. 5 (EQT027)

PWR-106 - Topgas Boiler No. 6 (EQT028)

PWR-107 - Topgas Boiler No. 7 (EQT029)

PWR-108 - Topgas Boiler No. 8 (EQT030)

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The blast furnace gas contains some sulfur dioxide as it exits the blast furnace, and very little in the way of any reduced sulfur compounds. Therefore, the analysis of SO<sub>2</sub> removal technologies address cleanup of the BFG prior to its combustion as fuel.

### Step 1 – Identify Potential Control Technologies

1. Wet Scrubber
2. Spray Dryer/Absorber (Dry Scrubber)
3. Dry Sorbent Injection

#### ***RBLC Listings for SO<sub>2</sub> Emissions from Blast Furnace Gas Combustion***

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Severstal North America, Inc	MI-0377	Blast Furnace Stoves	No Controls Feasible Compliance Verification Via CEMS	NA	14.37 6.62	Lb/MMscf Lb/MMscf

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

### Step 2 - Eliminate Technically Infeasible Options

The design average concentration of SO<sub>2</sub> exiting the blast furnace is very low (14 ppmv) and is below the post-control SO<sub>2</sub> concentrations achieved in coal-fired utility boilers (100 to 150 ppmv typical for new facilities burning 2.5 to 3% sulfur coal). None of the control options discussed below are effective for removal of SO<sub>2</sub> at the low concentrations anticipated at the exit of the blast furnace.

#### Wet Scrubber:

Wet scrubbers are not effective at removing low concentration of SO<sub>2</sub> (14 ppmv range) in a gas stream. Additionally, various operating problems are associated with the use of wet scrubbers to control SO<sub>2</sub> emissions from the combustion of blast furnace gas. When applied to the BFG prior to use as fuel in the hot blast stoves, there are potential problems with plugging of the downstream burners. Particulates can plug scrubber spray nozzles, packing, plates, and trays. Wet scrubbers also require handling, treatment, and disposal of a sludge by-product. In this case, air emissions would be exchanged for large scale water treatment and solid waste disposal requirements.

#### Spray dryer/Absorber (Dry Scrubber):

The spray dryer process would not have the wastewater treatment and disposal problems associated with the wet scrubbing systems, and the dried slurry resulting from SO<sub>2</sub> removal can be easily removed downstream by a baghouse. However, spray dryers are not effective at removing low concentrations of SO<sub>2</sub> in a gas stream.

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### **Dry Sorbent Injection:**

Dry sorbent injection would not result in the wastewater treatment and disposal problems associated with wet scrubbing systems. However, it would not be feasible to design an efficient system of dry sorbent injection to the blast furnace process, due to the very low SO<sub>2</sub> emission concentrations in the exhaust gas.

### **Step 3- Rank Remaining Technically Feasible Control Options**

In the previous analysis, available control technologies were reviewed for application to the SO<sub>2</sub> removal process. There are no technically feasible options remaining to be ranked for the control of SO<sub>2</sub> from BFG combustion in the topgas boilers.

### **Step 4 – Evaluate Remaining Control Technologies**

Various control alternatives were reviewed for technical feasibility in controlling SO<sub>2</sub> emissions from the topgas boilers. The application of each of the potential control options to the process was considered. Each of the available options has been eliminated as technically infeasible.

### **Step 5 – Selection of BACT**

A “top-down” BACT analysis was performed for SO<sub>2</sub> removal from the topgas boilers. This analysis determined that there are no add-on or combustion controls that represent BACT for SO<sub>2</sub> emissions from the combustion of blast furnace gas. BACT for top gas fuel is selected as no control. BACT for natural gas is to purchase natural gas containing no more than 2500 gr of Sulfur per MM scf.

### **BACT analyses for CO and VOC**

#### **Source ID – Description (EQT #)**

PWR-101 - Topgas Boiler No. 1 (EQT023)

PWR-102 - Topgas Boiler No. 2 (EQT024)

PWR-103 - Topgas Boiler No. 3 (EQT025)

PWR-104 - Topgas Boiler No. 4 (EQT026)

PWR-105 - Topgas Boiler No. 5 (EQT027)

PWR-106 - Topgas Boiler No. 6 (EQT028)

PWR-107 - Topgas Boiler No. 7 (EQT029)

PWR-108 - Topgas Boiler No. 8 (EQT030)

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### Step 1 – Identify Potential Control Technologies

1. Good Combustion Practices
2. Oxidizers

CO and VOCs are a result of incomplete combustion; as a result emissions can be minimized through the use of good combustion practices, including ensuring sufficient air to fuel ratios. The use of add-on oxidation technologies such as after-burners can also be considered to reduce CO and VOC emissions.

A search of the USEPA's RACT/BACT/LAER Clearinghouse was conducted to review control technologies that are in place today for several types of boilers. It can be seen that good combustion practices are the industry standard for controlling CO and VOC emissions from boilers. However, there are no recorded control efficiencies for this control.

#### ***RBLC Listings for CO Emissions from TopGas-Fired Boilers***

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Nucor Steel	IN-01018	Boiler, Nat. Gas	Good Combustion Practices, Natural Gas	NA	0.0610	lb/MMBtu
Steel Corr. Inc.	AR-0077	Boilers, Nat. Gas	Good Combustion Practice	NA	0.84	lb/MMBtu
Charter Steel	WI-0181	Boiler	Good Combustion Practice, Natural Gas	NA	No Emission Limit	

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

#### ***RBLC Listings for VOC Emissions from Top Gas-Fired Boilers***

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Nucor Steel	IN-01018	Boiler, Nat. Gas	Compliance by Using Natural Gas	NA	0.0026	lb/MMBtu
Steel Corr. Inc.	AR-0077	Boilers, Nat. Gas	Natural Gas Combustion Only	NA	0.0055	lb/MMBtu
Charter Steel	WI-0181	Boiler	Good Combustion Control, Natural Gas	NA	No Limit	

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

### Step 2 – Eliminate Technically Infeasible Options

#### Oxidizers:

In the case of a gas fired burner, an afterburner or downstream oxidizer would not result in an emission reduction because CO emissions typically are less than 1,000 ppm. Further oxidation would generate more NO<sub>x</sub> emissions and have little impact on CO.

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### **Step 3 – Rank Remaining Technically Feasible Control Options**

Like incineration, the destruction of CO and VOCs is expected to be in the 98-99% range for the boilers. This destruction is inherent to the boiler process, which has the aim to liberate all heat within the boiler.

### **Step 4 – Evaluate Remaining Control Technologies**

In boilers firing blast furnace gas, good combustion practices can lead to an overall CO reduction efficiency of 98 – 99%. A review of the RBLC database indicates that good combustion practice is the control method of choice for controlling CO emissions from other types of furnaces. Good combustion operation practices are considered the only feasible control method for reducing CO emissions.

### **Step 5 – Selection of BACT**

Using the top-down BACT selection method, only one option remains for CO and VOC emissions control from the topgas boilers. BACT is selected to be good combustion practices during the operation of the topgas-fired boilers and as 0.0824 lbs of CO per MM Btu, and 0.0054 lbs of VOC per MM Btu.

## **BACT DETERMINATION FOR SINTER PLANTS**

The sintering process converts fine-sized raw materials, including iron ore, coke breeze, limestone, mill scale, and flue dust, into an agglomerated product called sinter, of suitable size for charging into the blast furnace. The raw materials are sometimes mixed with water to provide a cohesive matrix, and then placed on a continuous, traveling grate called the sinter strand. A burner hood at the beginning of the sinter strand ignites the coke in the mixture, after which the combustion is self supporting. The combustion of the coke breeze provides sufficient heat, 1,300 – 1,480 °C (2,400 – 2,700 °F), to cause surface melting and agglomeration of the mix. On the underside of the sinter strand is a series of wind boxes that draw combusted air down through the material bed into a common duct, leading to a gas cleaning device.

The fused sinter is discharged at the end of the sinter strand, where it is crushed and screened. Undersize sinter is recycled to the mixing mill and back to the strand. The remaining sinter product is cooled in a circular cooler with mechanical fans or water sprays. The cooled sinter is crushed and screened for a final time, with the fines being recycled to the sintering process, and the product is sent to be charged to the blast furnaces. Generally, 2.3 Mg (2.5 tons) of raw materials, including water and fuel, are required to produce 0.9 Mg (1 ton) of product sinter.

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Nucor has proposed to install, an emerging technology for controlling multiple pollutants from the sintering process, known as the Maximized Emission Reduction Of Sintering (MEROS) system, which is currently installed and operating at the VoestAlpine steel works located in Linz, Austria. The MEROS system represents a state-of-art in sinter plant emissions control, and will provide BACT control for several pollutants.

### **BACT analyses for PM<sub>10</sub>**

#### **Source ID – Description (EQT #)**

SIN-101 - MEROS System Sinter Vent Stack (EQT031)

SIN-102 - Sinter Plant Main Dedusting Baghouse Vent (EQT032)

The sinter plant wind box exhaust is the primary source of particulate emissions; mainly iron oxides, sulfur oxides, carbonaceous compounds, aliphatic hydrocarbons, and chlorides. Feed material is loaded in a uniform layer on a moving grate called a sinter strand. Near the feed end of the strand, the bed is ignited on the surface by natural gas burners and, as the mixture moves along the traveling grate, air is pulled down through the mixture to burn the fuel by downdraft combustion. The firing ignites the undersize coke (coke breeze) in the feed, which forms a combustion front burning downward through the material layer as the grate moves toward the discharge end of the strand. As it moves, the strand passes through a series of windboxes which recycle hot flue gas through the sinter, which helps create sufficient heat and temperature to agglomerate the fine particles, forming a cake of porous clinker. The emissions from these wind boxes are routed to Source SIN-101. At the sinter strand discharge, emissions are mainly iron oxide and calcium oxide dusts. The cake of porous clinker is discharged from the sinter strand to a breaker which reduces the sinter to small pieces. The crushed product is then air cooled, and screened. NESHAP 40 CFR 63 Subpart FFFFF identifies the Sinter Discharge End and the Sinter Cooler as separate affected facilities. At the Nucor facility both of these areas of the Sinter Plant will be routed to the same control device identified as SIN-102, the Sinter Plant Main Dedusting Baghouse Vent.

#### **Step 1- Identify Potential Control Technologies**

1. Fabric Filter (baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubber
4. Cyclone



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### **Step 2 - Eliminate Technically Infeasible Options**

The evaluation for these filtering technologies must review whether the specific technology is available for the application and is effective at reducing PM<sub>10</sub> emissions from the sintering process.

#### Electrostatic Precipitator (ESP):

ESPs are sensitive to the physical characteristics of the particles to be collected. Iron and iron oxide particles adhere very strongly to the collection plate of the ESP due to their electromagnetic properties. They become very difficult to remove and thus reduce ESP efficiency. Zinc and other metal compounds tend to foul ESP electrodes, also reducing effectiveness. ESPs are considered technically infeasible as an available control technology for the sintering process.

### **Step 3- Rank Remaining Technically Feasible Control Options**

The control technologies that are potentially available to control PM<sub>10</sub> emissions from the sinter plant are ranked below according to their respective control efficiencies.

1. Fabric Filter (baghouse) – 99%
2. Wet Scrubber – 98%
3. Cyclone – 80%

Various control alternatives were reviewed for technical feasibility in controlling PM<sub>10</sub> emissions from the sinter plant. The highest ranking control option was identified to be the baghouse. PM<sub>10</sub> emissions could be reduced by up to 99% with the addition of baghouse filters.

### **Step 4 – Evaluate Remaining Control Technologies**

#### Fabric Filter (baghouse):

Fabric filters or baghouses are an industry standard for PM<sub>10</sub> control in many applications. Baghouses often are capable of 99% removal efficiencies. Baghouse removal efficiency is relatively level across the particle size range so that excellent control of all particle sizes can be obtained. Baghouses can be effectively applied to dust emissions from both the sinter strand discharge and the windbox. A fabric filter is integral to the MEROS control system.

#### Wet Scrubber:

Wet scrubbing systems can achieve 98% particulate removal efficiencies when properly applied. The primary obstacle to use of a wet scrubber system is handling and disposal of the collected wet

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sludge. One advantage of the sinter plant is that there is no wastewater to discharge. Use of a wet scrubber would not only require a wastewater treatment system but would add the need for a wastewater discharge. Therefore, a wet scrubber is not a technically feasible control for the sinter plant.

### Cyclones:

The dust particles could be separated by centrifugal forces imparted in a cyclone, however high velocity must be established and fine dust would not be effectively removed with the greatest efficiency. Multiple cyclones have overall mass removal efficiencies of 70-90%. However, cyclone collection efficiencies fall off rapidly with particle size, so that control of fine particulate (PM<sub>2.5</sub>) is limited.

### **Step 5 – Selection of BACT**

Using the top-down BACT selection method, three options remain for control of PM<sub>10</sub> emissions from the sinter plant. Therefore, BACT is selected to be the most stringent control option, a baghouse filter. The baghouse will also act as a PM<sub>10</sub> removal device for dust generated by SO<sub>2</sub> removal as part of the MEROS system. BACT for the Sinter Flue Gas Scrubber Stack is selected as PM<sub>10</sub> ≤ 0.002 gr/dscf (5 mg/dry std cubic meters). This emission rate will meet the MACT emission limitation of 0.3 lb/ton of product sinter, required under 40 CFR 63.7790(a). Thus, BACT will not be less stringent than MACT. BACT for the Sinter Plant Main Dedusting Baghouse Vent is selected as PM<sub>10</sub> ≤ 0.005 gr/dscf (12 mg/dry std cubic meters). This emission rate will meet the MACT emission limitation of 0.01 gr/dscf, required under 40 CFR 63.7790(a) for both the sinter end discharge and the sinter cooler. Thus, BACT will not be less stringent than MACT.

### **BACT analyses for NO<sub>x</sub>**

#### **Source ID – Description (EQT #)**

SIN-101 - Sinter Flue Gas Scrubber Stack (EQT031)

Sinter plant NO<sub>x</sub> originates with the combustion of coke and supplemental natural gas. Potential sinter plant NO<sub>x</sub> control technologies are listed and described below.

#### **Step 1 – Identify Potential Control Technologies**

1. Low NO<sub>x</sub> Burners (LNB)
2. Selective Catalytic Reduction (SCR)
3. Selective Non-Catalytic Reduction (SNCR)

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4. Non-Selective Catalytic Reduction (NSCR)

5. EM<sub>x</sub> (SCONO<sub>x</sub>)

### Step 2 – Eliminate Technically Infeasible Options

#### Low-NO<sub>x</sub> Burners (LNB):

External fuel is typically burned in a boiler that can be controlled using a low NO<sub>x</sub> burner as described in the section above. There is no external fuel source, other than the ignition source, that can be controlled during the sinter process. The coke breeze in the sinter mix burns in a smoldering fashion, so that the various materials are agglomerated by the heat. LNBs are not technically feasible for application to the sintering process because the combustion of the coke breeze is not done through the burning of external fuel.

#### Selective Catalytic Reduction (SCR):

SCR requires the injection of ammonia into a gas stream upstream of a catalyst bed, at a specific temperature range. Frequently, excess unreacted ammonia will remain in the gas beyond the catalyst bed, an occurrence known as ammonia slip. Ammonia slip is incompatible with the sulfur control technology chosen as BACT for sintering. Ammonia is known to react with hydrated lime to form complex compounds. These compounds are viscous, and have been known to plug piping and foul catalysts. SCR is not technically feasible because a complete separation of ammonia for NO<sub>x</sub> control, and hydrated lime for SO<sub>2</sub> control, cannot be achieved.

#### Selective Non-Catalytic Reduction (SNCR):

SNCR requires injection of a reagent into the gas stream. The required temperature window for this to take place (i.e., 1,600 – 2,200 °F) is only available for a short period of time during the process and only occurs within the burning zone. It is technically infeasible to control the injection of the reagent into the gas stream that is within the temperature window, since the size and location is highly variable. If the injection takes place outside the temperature window (i.e. at less than 1,600 °F), the SNCR controls will not result in reduced NO<sub>x</sub> emissions. For these reasons, SNCR is not technically feasible for the sintering process.

#### Non-Selective Catalytic Reduction (NSCR):

Non-selective catalytic reduction requires specific levels of several process parameters that are incompatible with the flue gas stream leaving the sinter plant. The flue gas will contain some lime and metal particulates which will scale and plug the catalyst beds used for NSCR. Additionally, the flue gas will not be within the temperature range required by NSCR when it leaves the desulfurization unit. Thus NSCR is not a feasible control technology for the control of CO from topgas boilers.

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### EM<sub>x</sub> (SCONO<sub>x</sub>):

EM<sub>x</sub> technology uses catalyst beds with narrow, honeycomb structures. The flue gas stream leaving the sinter plant will contain some lime and metal particulates which will scale and plug the catalyst beds used for EM<sub>x</sub>. Additionally, the flue gas will not be within the temperature range required by EM<sub>x</sub> when it leaves the desulfurization unit. Thus, EM<sub>x</sub> is a technically infeasible control technology for the hot blast stoves.

### **Step 3 – Rank Remaining Technically Feasible Control Options**

There are no remaining control options which are technically feasible.

### **Step 4 – Evaluate Remaining Control Technologies**

There are no remaining control options to evaluate.

### **Step 5 – Selection of BACT**

A top-down BACT analysis was performed for NO<sub>x</sub> emissions from the sinter plant. There are no feasible options for NO<sub>x</sub> control from the sinter plant; therefore, BACT is selected to be no control. BACT is established as 0.495 lbs/ton of finished sinter.

### **BACT analyses for SO<sub>2</sub>**

#### **Source ID – Description (EQT #)**

SIN-101 - Sinter Flue Gas Scrubber Stack (EQT031)

Sinter plant SO<sub>2</sub> emissions originate from the combustion of coke and supplemental natural gas. Potential sinter plant SO<sub>2</sub> control technologies are listed and described below.

### **Step 1- Identify Potential Control Technologies**

1. Wet Scrubber Flue Gas Desulfurization
2. Spray Dryer/Absorber (Lime Spray Dryer)
3. Dry Sorbent Injection

### **Step 2 - Eliminate Technically Infeasible Options**

The evaluation of these technologies must review whether the specific technology is available for the application and is effective at reducing SO<sub>2</sub> emissions from the sintering process. All of the above mentioned technologies are technically feasible and are able to be applied to the sinter plant.

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However the wet scrubber will result in higher PM<sub>10</sub> emissions than the baghouse control technology chosen as BACT for PM<sub>10</sub> control from this source and therefore is eliminated as a technically feasible option.

### **Step 3 – Rank Remaining Technically Feasible Control Options**

1. Spray Dryer/Absorber (Lime Spray Dryer) – 70 – 90%
2. Dry Sorbent Injection – 40 – 60%

### **Step 4 – Evaluate Remaining Control Technologies**

#### Spray Dryer/Absorber (Lime Spray Dryer):

One advantage of the sintering process is that it produces no process wastewater. A significant advantage of dry scrubbing is that it provides high SO<sub>2</sub> removal without generating wastewater. Another advantage is that a spray dryer and baghouse system combination is a very effective particulate removal device.

#### Dry Sorbent Injection:

The SO<sub>2</sub> control efficiency of existing dry injection systems range from 40 to 60 percent when using lime or limestone. Other sorbents have been used at higher efficiency in other desulfurization applications but are still considered to be a developing rather than demonstrated technology.

### **Step 5 – Selection of BACT**

A top-down BACT analysis was performed for SO<sub>2</sub> removal from the sinter plant. With the considerations noted above, a dry scrubber, with a removal efficiency of 90%, was selected as BACT for SO<sub>2</sub> emissions. The baghouse selected for PM<sub>10</sub> control discussed above is also considered BACT for dust generated by SO<sub>2</sub> removal. BACT is established as 1.0573 lbs/ton of finished sinter.

#### BACT analyses for CO

##### **Source ID – Description (EQT #)**

SIN-101 - Sinter Flue Gas Scrubber Stack (EQT031)

Sinter plant CO emissions originate from the combustion of coke and supplemental natural gas fuel. Potential sinter plant CO control technologies are listed and described below.

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### **Step 1- Identify Potential Control Technologies**

1. Good Combustion Practices
2. Catalytic Oxidizer
3. Thermal Oxidizer
4. Ultra low emission Flare

#### Catalytic Oxidizer:

Beyond combustion controls, the remaining CO could be oxidized to carbon dioxide (CO<sub>2</sub>) in a second downstream control device. Gas streams with high concentrations of CO can be controlled by installing a catalytic oxidizer downstream of the device. The oxidation process occurs at a relatively low temperature by moving the gases across a bed of catalyst material consisting of a precious metal such as palladium. This can be practical when CO levels are elevated above 1,000 ppmv, such as in certain chemical processes or combustion units that have a wet fuel or for some reason promote incomplete combustion.

#### Thermal Oxidizer:

A thermal oxidizer works in a similar manner to catalytic oxidation devices, combusting pollutants to CO<sub>2</sub> and water prior to being released to the atmosphere. Thermal oxidizers generally operate at a higher temperature than catalytic devices, requiring the gas stream to be heated during treatment. Typically, the gas is heated to a temperature of at least 1,400 °F, and a minimum residence time at this temperature is required (typically between 0.5 - 2.0 seconds). These parameters can be practically achieved when emissions contain high concentrations of VOC or other combustible compounds, and the gas flow is relatively low.

#### Ultra-Low Emission Flare

Combusting a waste gas stream is a common method of removing CO or other combustible matter from a gas stream. Flares come in many forms and designs, and generally operate by igniting a waste gas stream directly. Flares may be steam-assisted, air-assisted or non-assisted, and typically require a minimum fuel value of the waste gas in order to operate effectively.

### **Step 2 - Eliminate Technically Infeasible Options**

#### Catalytic Oxidizer:

A catalytic oxidizer relies upon expensive catalyst beds to promote the oxidation of CO to CO<sub>2</sub>. The catalyst beds are made of precious metals such as palladium or platinum. These catalysts are frequently poisoned by certain materials, particularly other metals such as iron, lead and silicon.

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Iron particles are heavily prevalent in the sinter flue gas, and catalyst poisoning is a severe obstacle to the application of catalytic oxidation to sinter plant flue gas. Catalytic oxidation has never been demonstrated as effective for treating CO from sinter plants, and is therefore determined to be technically infeasible.

### Ultra-Low Emission Flare

For emission flares to be effective, the process gas must be combustible. The flue gas in the sintering process has very little fuel value, with only minor concentrations of CO and VOC present in the gas. An Ultra-Low Emission Flare is not feasible because the concentrations of flammable compounds in the sinter flue gas are not adequate for combustion to take place. If the flare cannot be ignited, it can not perform its function and the technique is therefore determined to be technically infeasible.

### **Step 3 – Rank Remaining Technically Feasible Control Options**

Good combustion practice is the only technically feasible control for CO emissions from the sinter plant. A review of publicly available information for the reduction of CO from the sintering process did not reveal any currently applied control technologies.

### **Step 4 – Evaluate Remaining Control Technologies**

1. Thermal Oxidizer – 99%
2. Good Combustion Practices – N/A

### Thermal Oxidizer:

Thermal oxidation is technically feasible for the control of CO from the sintering process. As an active control measure it is generally capable of 99% control of combustibles such as CO and VOCs.

A thermal oxidizer applied to the sintering process would require a large amount of energy to heat the flue gas to a temperature at which thermal oxidation could take place. The only effective means of supplying this energy would be through the combustion of natural gas or other gaseous fuels. The combustion of natural gas necessarily entails the generation of air pollutants, with NO<sub>x</sub> production of particular concern.

The sinter plant design calls for a normal exhaust gas flow rate from the windbox of approximately 466,160 actual cubic feet per minute (acfm) at 160 °F. In order to treat this waste gas, containing approximately 1% CO by volume, a gas stream of nearly 28,000,000 cubic feet per hour must be heated by approximately 1,250 °F. Even granting generous assumptions of thermal efficiency and economy, the energy requirements for a thermal oxidizer of this size would be very

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large, requiring tens of thousands of cubic feet of natural gas. The consequent generation of NO<sub>x</sub> emissions from this use of fuel, a precursor of ozone formation, counteracts and outweighs any potential environmental benefit from reduced emissions of CO.

Although thermal oxidation is a feasible control technology for emissions of CO, the reduction in CO is greatly outweighed by energy and environmental costs associated with this type of control. Therefore, this technology is eliminated from consideration because it has unacceptable energy and environmental impacts.

### Good Combustion Practices:

Carbon monoxide (CO) is a result of incomplete combustion; therefore, it can typically be minimized through the use of good combustion practices including assurance of sufficient air to fuel ratios. Good combustion practices can be enhanced using staged combustion, which involves the injection of combustion air at different areas of the burners. Therefore, good combustion practices will be utilized to partially control CO emissions from the sinter plant.

### **Step 5 – Selection of BACT**

A top-down BACT analysis was performed for CO removal from the sinter plant. BACT is selected to be good combustion practices, which represents the only remaining means of reducing CO emissions from the sinter plant. BACT is also determined to be CO ≤ 17.9416 lb/ton of finished sinter.

### **BACT analyses for VOC**

#### **Source ID – Description (EQT #)**

**SIN-101 - Sinter Flue Gas Scrubber Stack (EQT031)**

Sinter plant VOC emissions originate from the combustion of coke and supplemental natural gas fuel. Potential sinter plant VOC control technologies are listed and described below.

### **Step 1- Identify Potential Control Technologies**

1. Good combustion practices
2. Thermal Oxidizer
3. Ultra-Low Emission Flare
4. Countercurrent flow injection of additives



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### **Good Combustion Practices:**

Near the feed end of the grate, the bed is ignited on the surface by gas burners and, as the mixture moves along the traveling grate, air is pulled down through the mixture to burn the fuel by downdraft combustion. This creates sufficient heat and temperature to agglomerate the fine particles, forming a cake of porous clinker, and providing the strength and other properties needed for use in the blast furnace. VOC compounds are formed as products of combustion as the coke is burned to melt the sinter and flux. VOC can generally be combusted in equipment utilizing burners in different stages of combustion processes. However, the sintering process is a self-sustaining burn that only uses a burner to ignite the mass. The VOC concentration in the flue-gas is typically low.

### **Countercurrent flow injection of additives:**

VOC compounds can be controlled with the injection of additives in the flow stream which adsorb them. The MEROS system mixes coke breeze particles with the lime spray such that the coke breeze acts as activated carbon injected into the flue gas. The injection of additives in this manner has not been demonstrated to be particularly effective at VOC control, with removal efficiency estimated to be about 12%. However, the coke breeze injection is highly effective at the removal of several Hazardous Air Pollutants, and thus will be an integral part of the MEROS control system.

## **Step 2 - Eliminate Technically Infeasible Options**

### **Ultra-Low Emission Flare**

For emission flares to be effective, the process gas must be combustible. The flue gas in the sintering process has very little fuel value, with only minor concentrations of CO and VOC present in the gas. An Ultra-Low Emission Flare is not feasible because the concentrations of flammable compounds in the sinter flue gas are not adequate for combustion to take place. If the flare cannot be ignited, it can not perform its function and the technique is therefore determined to be technically infeasible.

## **Step 3- Rank Remaining Technically Feasible Control Options**

1. Thermal Oxidizer – 99%
2. Countercurrent flow injection of additives – 12%
3. Good combustion practices – N/A

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### **Step 4 – Evaluate Remaining Control Technologies**

Thermal oxidation is technically feasible for the control of VOC from the sintering process. As an active control measure it is generally capable of 99% control of combustibles such as CO and VOCs.

A thermal oxidizer applied to the sintering process would require a large amount of energy to heat the flue gas to a temperature at which thermal oxidation could take place. The only effective means of supplying this energy would be through the combustion of natural gas or other gaseous fuels. The combustion of natural gas necessarily entails the generation of air pollutants, with NO<sub>x</sub> production of particular concern.

The sinter plant design calls for a normal exhaust gas flow rate from the windbox of approximately 466,160 actual cubic feet per minute (acfm) at 160 °F. In order to treat this waste gas, containing approximately 200ppm of VOCs, a gas stream of nearly 28,000,000 cubic feet per hour must be heated by approximately 1,250 °F. Even granting generous assumptions of thermal efficiency and economy, the energy requirements for a thermal oxidizer of this size would be very large, requiring tens of thousands of cubic feet of natural gas. The consequent generation of NO<sub>x</sub> emissions from this use of fuel, a precursor of ozone formation, counteracts and outweighs any potential environmental benefit from reduced emissions of VOC.

Although thermal oxidation is a feasible control technology for emissions of VOC, the reduction in VOC is greatly outweighed by energy and environmental costs associated with this type of control. Therefore, this technology is eliminated from consideration because it has unacceptable energy and environmental impacts.

A review of publicly available information for the reduction of VOC from the sintering process did not reveal any currently applied control technologies. Because the expected control efficiency of additive injection is not high, a combined approach of additive injection and good combustion practices would provide the best control of VOC.

### **Step 5 – Selection of BACT**

A top down BACT analysis was conducted for VOC reduction from the sinter plant. BACT is selected to be countercurrent flow injection of additives combined with good combustion practices to control VOC emissions from the sinter plant. BACT is also determined to be VOC, Total ≤ 0.1074 lb/ton of finished Sinter.

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### BACT DETERMINATION FOR COOLING TOWERS

Most industrial cooling towers use clarified river water or well water as their source of fresh cooling water. The cross-flow cooling towers continuously circulate cooling water through heat exchangers and other equipment where the water absorbs heat. That heat is then rejected to the atmosphere by the partial evaporation of the water in cooling towers where up-flowing air is contacted with the circulating down-flow of water. The loss of evaporated water into the air exhausted to the atmosphere is replaced by "make-up" water. Since the evaporation of pure water is replaced by make-up water containing carbonates and other dissolved salts, a portion of the circulating water is also continuously discarded as "blowdown" water to prevent the excessive build-up of salts in the circulating water.

#### BACT analyses for PM<sub>10</sub>

##### **Source ID – Description (EQT #)**

TWR-101 - Blast Furnace Cooling Tower (EQT060)

TWR-102 - Iron Solidification Cooling Tower (EQT061)

TWR-103 - Air Separation Plant Cooling Tower (EQT062)

#### **Step 1 – Identify All Control Technologies**

1. High-efficiency drift eliminators
2. Low TDS cooling water

#### Drift Eliminators:

Water droplets that are carried out of the cooling tower with the exhaust air are known as drift droplets. PM<sub>10</sub> is created when the water evaporates from the droplet, leaving the previously dissolved salt behind as particulate matter. The drift rate is typically reduced by employing baffle-like devices, called drift eliminators, through which the air must travel after leaving the fill and spray zones of the tower. In the drift eliminators, small droplets are agglomerated into large droplets and removed from the air stream discharged from the cooling tower.

#### Low TDS Cooling Water:

By maintaining a low level of total dissolved solids in the circulating cooling water, the amount of particulate matter generated by the drift can be greatly reduced. A TDS concentration of 1,100 ppmv or less is typically considered to be a low concentration in cooling tower water.

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A search of the U.S. EPA RBLC database was conducted to review control options for PM<sub>10</sub> emissions for cooling towers in use today. The most common type of control device is a drift eliminator.

### *RBLC Listings for PM<sub>10</sub> Emissions from Cooling Towers*

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
CLECO Power, LLC – Rodemacher Brownfield Unit 3	LA-0202	Cooling Tower (16 Cells)	Drift Eliminators	99.995%	0.005%	Cooling Water Drift
Nucor Steel	NC-0112	Cooling Towers	Mist Eliminators	99.992%	0.008%	Cooling Water Drift
Nucor Steel	NC-0113	Cooling Towers	Mist Eliminators	99.992%	0.008%	Cooling Water Drift
Western Greenbrier Co-Generation, LLC	WV-0024	Cooling Tower	Drift Eliminators	99.9995%	0.0005%	Cooling Water Drift
Great RiverEnergy – Spiritwood Station	ND-024	Cooling Tower	Drift Eliminator	99.9995%	0.0005%	Cooling Water Drift

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

### **Step 2 – Eliminate Technically Infeasible Options**

The evaluation of these technologies must review whether the specific technology is available for the application and is effective at reducing PM<sub>10</sub> emissions from the cooling towers. BACT will be chosen as the most efficient and economical option.

#### High-Efficiency Drift Eliminators:

Drift eliminators are technically feasible and are able to be applied to reduce PM<sub>10</sub> emissions from cooling towers. Drift eliminators are an industry standard, and are supplied with the cooling tower by most vendors.

#### Low TDS Cooling Water:

Total dissolved solids are normally maintained at a reasonably low level in cooling towers to prevent deposition and fouling. Reduction in TDS to very low levels requires a significant increase in makeup water usage and treatment chemicals, due to a significant increase in the blow-down required. Low TDS concentration is a technically feasible option for PM control from cooling towers.

### **Step 3 – Rank Remaining Technically Feasible Control Options**

1. Low TDS Cooling Water – 50 – 90%
2. High-Efficiency Drift Eliminators – 50 – 80%

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### Low TDS Cooling Water:

By reducing the TDS concentration to less than 1,100 ppm, particulate can typically be controlled to a high degree.

### High-Efficiency Drift Eliminators:

Drift eliminators are often used to reduce the amount of drift in the exiting air flow. The four main types of drift eliminators are blade-type, herringbone, waveform, and cellular or honeycomb. Blade-type and herringbone drift eliminators are usually the least efficient; waveform drift eliminators are typically moderately efficient; cellular units are the most efficient.

### **Step 4 – Evaluate Remaining Control Technologies**

Most of the emissions from cooling towers are a result of drift droplets, liquid water entrained in the air stream which are carried out of the tower. The amount of drift escaping the cooling tower depends on the type and model, the capacity, the velocity of the air, the temperature of the inlet and outlet flow, and the density of the air in the cooling tower. Drift loss can usually be obtained by requesting the drift loss from the manufacturer or vendor. Drift droplets can be reduced to less than 0.005% by effectively using a drift eliminator.

### **Step 5 – Selection of BACT**

A top-down BACT analysis was performed for PM<sub>10</sub> control from cooling towers. Both remaining options are effective, depending upon specific process conditions. Therefore, BACT is selected to be a combination of less than or equal to 1,100 milligrams per liter TDS concentration in the cooling water and drift eliminators employing a drift maximum of 0.0005%.

## **BACT DETERMINATION FOR STORAGE PILES AND ROADWAYS**

Storage piles are usually left uncovered, partially because of the need for frequent material transfer into or out of storage. Dust emissions occur at several points in the storage cycle, such as material loading onto the pile, disturbances by strong wind currents, and loadout from the pile. The movement of trucks and loading equipment in the storage pile area is also a source of dust.

### **BACT analyses for PM<sub>10</sub>**

#### **Source ID – Description (EQT #)**

PIL-101 - Coal Storage Piles (FUG001)

PIL-102 - Iron Ore Pellet Storage Piles (FUG002)

PIL-103 - Flux Storage Piles (FUG003)

PIL-104 - Pig Iron Storage Piles (FUG004)

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PIL-105 - Granulated Slag Storage Piles (FUG005)

PIL-106 - Sinter Storage Piles (FUG006)

PIL-107 - Coke Breeze Storage Piles (FUG007)

PIL-108 - Mill Scale Storage Piles (FUG008)

FUG-101 - Unpaved Road Fugitive Dust (ARE002)

FUG-102 - Paved Road Fugitive Dust (ARE003)

### Step 1 – Identify Potential Control Technologies

1. Application of surfactants, cover, wet suppression, and or stabilizers to exposed surfaces
2. Minimize handling of storage pile materials

#### *RBLC Listings for PM<sub>10</sub> Emissions from Storage Piles*

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Recmix of PA, Inc.	KY-0095	Stockpiles	Material has high moisture content	90%	0.78	t/yr
Recmix of PA, Inc.	KY-0095	Storage	High moisture content	90%	0.78	t/yr
Chaparral Steel Midlothian LP	TX-0332	Stockpiles	NA	NA	0.21	t/yr

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

### Step 2 – Eliminate Technically Infeasible Options

The evaluation for these control options must review whether the specific technology is available for the application and is effective at reducing PM<sub>10</sub> emissions from storage piles. All of the above mentioned controls are technically feasible controls for reducing PM<sub>10</sub> emissions from storage piles.

### Step 3 – Rank Remaining Technically Feasible Control Options

The use of water suppression can control PM<sub>10</sub> emissions by up to 90%. Dust generation can also be reduced by minimizing the handling of storage pile materials.

### Step 4 – Evaluate Remaining Control Technologies

Watering and the use of chemical wetting agents are the principal means for control of storage pile emissions. Watering is useful mainly to reduce emissions from vehicle traffic in the storage pile area. Watering of the storage piles themselves typically has only a very temporary slight effect on total emissions. A much more effective technique is to apply chemical agents such as surfactants that permit more extensive wetting. Continuous chemical treating of material loaded onto piles, coupled with watering or treatment of roadways, can reduce total particulate emissions from storage operations by up to 90 percent.

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### Step 5 – Selection of BACT

A top-down BACT analysis was performed for storage pile emissions. BACT is determined to be wet suppression of dust generating sources by water sprays at each storage pile site. Roadways shall be paved where practicable; reduced speed limits shall be utilized and roadways shall be sprayed to reduce emissions.

### BACT DETERMINATION FOR HOT METAL HANDLING

PM<sub>10</sub> is emitted as a result of the transfer of molten metal from one vessel to the other. The transfer of molten metal accounts for significantly more particulate emissions than are generated from the melting processes themselves. The following analysis provides the BACT determination for PM<sub>10</sub> emissions.

#### BACT analyses for PM<sub>10</sub>

##### **Source ID – Description (EQT #)**

PIG-101 - Pig Iron Desulfurization Station Baghouse Vent (EQT021)

PIG-102 - Pig Iron Solidification Baghouse Vent (EQT022)

### Step 1 – Identify Potential Control Technologies

The options that are potentially available to control PM<sub>10</sub> emissions from the hot metal handling operations include the following:

1. Fabric Filter (baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubber

#### *RBLC Listings for PM<sub>10</sub> Emissions from Hot Metal Handling*

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Asama Coldwater Manufacturing, Inc.	MI-0385	Melting and Pouring (EU-MP)	(A) Hoods, Enclosures, Ductwork and a 37,500 ACFM Baghouse	99%	0.3	lb/hr

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

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### **Step 2 – Eliminate Technically Infeasible Options**

#### Electrostatic Precipitator (ESP):

ESPs are capable of 99% or higher particulate removal; however several factors preclude their application to control PM<sub>10</sub> from hot metal handling processes. ESPs are sensitive to the physical characteristics of the particles to be collected. Iron particles adhere very strongly to the collection plate of the ESP due to their electromagnetic properties. They become very difficult to remove and thus reduce ESP efficiency. Zinc and other metal compounds tend to foul ESP electrodes, also reducing effectiveness. ESPs are considered technically infeasible as an available control technology for hot metal handling processes.

### **Step 3 – Rank Remaining Technically Feasible Control Options**

1. Fabric Filter (baghouse) – 99%
2. Wet Scrubber – 98%

### **Step 4 – Evaluate Remaining Control Technologies**

#### Fabric Filter (baghouse):

Fabric filters are the standard in the iron and steel industry for PM<sub>10</sub> control. Baghouses often are capable of 99% removal efficiencies. Baghouse removal efficiency is relatively level across the particle size range, so that excellent control of PM<sub>10</sub> can be obtained. Baghouse installations are technically feasible and are the industry standard for controlling PM<sub>10</sub> emissions from hot metal handling.

#### Wet Scrubber:

High-energy wet scrubbers are technically feasible but have many disadvantages compared to fabric filters, which can achieve better levels of particulate control. Scrubber systems have very high pressure drops that result in high system operating costs. They also require water treatment and sludge disposal, which are not necessary with other PM<sub>10</sub> control options. They also have large space requirements.

### **Step 5 – Selection of BACT**

A top-down BACT analysis was performed for PM<sub>10</sub> control from hot metal handling. BACT for controlling filterable PM<sub>10</sub> emissions from hot metal handling processes is selected as a baghouse with a vent hood. This combination offers a capture and control efficiency of 99% for PM<sub>10</sub>. BACT is established as 0.009 lbs/ton of hot metal processed for the PIG-101 - Pig Iron



## PRELIMINARY DETERMINATION SUMMARY

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**Agency Interest No.: 157847**

**Consolidated Environmental Management Inc**

**Convent, St. James Parish, Louisiana**

**PSD-LA-740**

**October 1, 2008**

Desulfurization Station Baghouse Vent. BACT is established as 0.0019 lbs/ton of hot metal processed for the PIG-102 - Pig Iron Solidification Baghouse Vent.

### BACT DETERMINATION FOR STOCK HOUSE AND SINTER MATERIAL HANDLING

PM<sub>10</sub> is emitted as a result of the transfer of various products from the stock houses and after the Sinter is finished being cooled. The Stock House materials consist of the following products: Iron ore, Ore fines, Coke, and Nut coke. The Sinter materials consist of Lime used to control sulfur dioxide emission from the Sinter Plant and fine and other materials. The following analysis provides the BACT determination for PM<sub>10</sub> emissions.

#### BACT analyses for PM<sub>10</sub>

##### **Source ID – Description (EQT #)**

STC-101 - Stock House 1 Baghouse Vent (EQT053)

STC-201 - Stock House 2 Baghouse Vent (EQT054)

SIN-103 - Coke and Petcoke Crushing Dedusting Baghouse Vent (EQT033)

SIN-105 - Sinter FGD Lime Silo Unloading (EQT034)

SIN-106 - Sinter FGD Waste Loading (EQT035)

#### **Step 1 – Identify Potential Control Technologies**

The options that are potentially available to control PM<sub>10</sub> emissions from the material handling operations include the following:

1. Fabric Filter (baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubber

#### **Step 2 – Eliminate Technically Infeasible Options**

##### Electrostatic Precipitator (ESP):

ESPs are capable of 99% or higher particulate removal; however several factors preclude their application to control PM<sub>10</sub> from these processes. ESPs are sensitive to the physical characteristics of the particles to be collected. Iron particles adhere very strongly to the collection plate of the ESP due to their electromagnetic properties. They become very difficult to remove and thus reduce ESP efficiency. Zinc and other metal compounds tend to foul ESP electrodes, also reducing effectiveness. ESPs are considered technically infeasible as an available control technology for hot metal handling processes.

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### **Step 3 – Rank Remaining Technically Feasible Control Options**

1. Fabric Filter (baghouse) – 99%
2. Wet Scrubber – 98%

### **Step 4 – Evaluate Remaining Control Technologies**

#### Fabric Filter (baghouse):

Fabric filters are the standard in the iron and steel industry for PM<sub>10</sub> control. Baghouses often are capable of 99% removal efficiencies. Baghouse removal efficiency is relatively level across the particle size range, so that excellent control of PM<sub>10</sub> can be obtained. Baghouse installations are technically feasible and are the industry standard for controlling PM<sub>10</sub> emissions from hot metal handling.

#### Electrostatic Precipitator (ESP):

ESP control of the Sinter Plant material handling is technically feasible. However, compared only to the fabric filter control, the efficiency of ESP devices are slightly lower, and capital and operating costs are greatly increased. Baghouse control is typically preferred over ESP control absent factors which make fabric filters infeasible.

#### Wet Scrubber:

High-energy wet scrubbers are technically feasible but have many disadvantages compared to fabric filters, which can achieve better levels of particulate control. Scrubber systems have very high pressure drops that result in high system operating costs. They also require water treatment and sludge disposal, which are not necessary with other PM<sub>10</sub> control options. They also have large space requirements.

### **Step 5 – Selection of BACT**

A top-down BACT analysis was performed for PM<sub>10</sub> control from the products handled in the Stock Houses and the Sinter Plant. BACT for controlling filterable PM<sub>10</sub> emissions is selected as a baghouse. This offers a control efficiency of 99% for PM<sub>10</sub>.

### **BACT DETERMINATION FOR MATERIAL HANDLING AND TRANSFER**

Large quantities of raw materials will be received at Nucor Steel Louisiana, and then transported for use within the facility. Most materials will be received at the Mississippi River dock, which will have the capability to berth large, ocean-going vessels and river barges. Two gantry cranes will work the receiving dock, unloading materials by clamshell bucket. Materials may also be

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received by rail and by truck. A dedicated wagon tipper will be installed and operated for unloading rail cars. Within the facility, the bulk of material handling and transport will be accomplished using conveyors. Dedicated stacker/reclaimer machines will form storage piles of raw materials as they are received, and reclaim them for use in the process as operations demand.

PM<sub>10</sub> is emitted as a result of handling and transporting bulk quantities of raw materials. Materials such as coal, iron ore pellets, limestone and others generate dusts as the individual pieces impact one another. These raw materials will be unloaded from ships and barges using a clamshell unloader mounted to a gantry crane, or from rail cars employing a wagon tipper. Materials will primarily be moved about the Nucor Steel Louisiana facility by conveyor, which has the potential to generate fugitive dusts at drop points, and due to wind. Inevitably, materials will also be transported by truck or managed with earth-moving equipment, which have the potential to generate fugitive road dust. The following analysis provides the BACT determination for PM<sub>10</sub> emissions.

### **BACT analyses for PM<sub>10</sub>**

#### **Source ID – Description (EQT #)**

DOC-101 - Dock 1 Loading/Unloading Gantry Crane (EQT017)  
 DOC-102 - Dock 2 Loading/Unloading Gantry Crane (EQT018)  
 DST-101-Blast Furnace 1 Topgas Dust Catcher (EQT019)  
 DST-201-Blast Furnace 2 Topgas Dust Catcher (EQT020)  
 FUG-103 - Conveyor Fugitives (ARE004)  
 COK-112 - Coke Battery 1 FGD Lime Silo Unloading (EQT005) [FF]  
 COK-113 - Coke Battery 1 FGD Waste Loading (EQT006) [FF]  
 COK-212 - Coke Battery 2 FGD Lime Silo Unloading (EQT011) [FF]  
 COK-213 - Coke Battery 2 FGD Waste Loading (EQT012) [FF]  
 COK-214 - Coke Bin Tower (EQT013) [FF]  
 COK-215 - Coke Screening (EQT014) [FF]  
 TRN-101 - Wagon Tipper (EQT059)

### **Step 1 – Identify Potential Control Technologies**

1. Fabric Filter [FF] (baghouse)
2. Wind screens and partial enclosures
3. Water sprays or wet suppression
4. Enclosed (hooded) conveyors and transfer points

RBLC data for PM<sub>10</sub> controls for material handling operations is seen in the table below. It is evident that the range of technologies cited above has been used as BACT for the various aggregate handling operations. All of the above options are considered technically feasible.

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### ***RBLC Listings for PM<sub>10</sub> Emissions from Material Handling***

<b>Facility</b>	<b>RBLC ID</b>	<b>Unit</b>	<b>Control Technology</b>	<b>Control Efficiency</b>	<b>Emission Limit</b>	<b>Units</b>
Louisiana Generating – Big Cajun I Power Plant	LA-0223	Transfer Points – Barge Unloader, Unloading Hopper to Conveyor C-1	Wind Screens and Dry Fogging	NA	0.13	Lb/hr
Entergy Louisiana, LLC – Little Gypsy Generating Plant	LA-0221	Raw Material Handling Conveyors	Wind Screens and Wet Suppression	NA	37.42	Lb/hr
Big River Industries, Inc.	LA-0209	Conveyor Systems and Stockpiles	Water Sprays and/or Partial Enclosure	90%	0.1	lb/hr
NRG Texas	TX-0507	Limestone Conveyors	No controls	NA	0.77	Lb/hr
CLECO Power, LLC	LA-0202	Outside Conveyors	Hooded Conveyors	95%	3.6	lb/hr

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

### **Step 2 – Eliminate Technically Infeasible Options**

All of the above mentioned technologies can be applied to control PM<sub>10</sub> emission sources due to aggregate handling. There are areas where water suppression may not be practical such as areas that are enclosed. There are also areas where enclosures are not practical, such as process loading bins, where water suppression might be a more effective means of controlling emissions.

### **Step 3 – Rank Remaining Technically Feasible Control Options**

1. Fabric Filter (baghouse) – 99%
2. Enclosed conveyors and transfer points – 95%
3. Water sprays and wet suppression – 90%
4. Wind screens and partial enclosures – 60%

### **Step 4 – Evaluate Remaining Control Technologies**

#### **Fabric Filter (baghouse):**

Fabric filters are the standard in the iron and steel industry for PM<sub>10</sub> control. Baghouses often are capable of 99% removal efficiencies. Baghouse removal efficiency is relatively level across the particle size range, so that excellent control of PM<sub>10</sub> can be obtained. Baghouse installations are technically feasible and are the industry standard for controlling PM<sub>10</sub> emissions from some types of material handling.

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### Enclosed Conveyors and Transfer Points:

Enclosed conveyor systems prevent strong winds from lifting silt and dust from raw materials as they are moved on a conveyor belt. Enclosed conveyors are frequently used when conveyor systems are designed for dry materials such as coal, aggregates or grain.

### Water Sprays and Wet Suppression:

Water sprays are frequently employed at specific dust-generating points where dry materials are dropped or transferred, such as load bins and transfer/drop points. Water sprays cannot be employed upon materials which have an adverse reaction to water, such as materials with cementitious properties. Water sprays are very effective at controlling dusts by weighing down the dust particles.

### Wind Screens and Partial Enclosures:

Wind screens and partial enclosures work in a manner similar to enclosed conveyors, but are not specific to one type of equipment, and are frequently erected at drop points and transfer areas to minimize the possibility of strong wind entraining dust particles.

## **Step 5 – Selection of BACT**

BACT is selected to be enclosed conveyors as the most stringent control option for material handling conveyors. Water sprays and partial enclosures are additional control methods which will be employed at specific and drop points. BACT for the various loading and unloading operations and similar sources is selected as collection and control by fabric filters.

## **B. ANALYSIS OF EXISTING AIR QUALITY**

Prevention of Significant Deterioration regulations require an analysis of existing air quality for those pollutants to be emitted in significant amounts from a proposed facility. PM<sub>10</sub>, SO<sub>2</sub>, NO<sub>x</sub>, CO, and VOC are pollutants of concern in this case.

AERMOD modeling of CO emissions from the proposed project indicates that the maximum offsite ground level concentrations of this pollutant will be below its respective PSD significance level and preconstruction monitoring level. Therefore, pre-construction monitoring, refined NAAQS modeling, and increment consumption analyses was not required.

However, the model predicted that PM<sub>10</sub>, NO<sub>x</sub>, and SO<sub>2</sub> emissions would exceed the significance level; consequently, refined NAAQS modeling and increment consumption analyses were required.

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VOC and NO<sub>x</sub> emissions from the proposed facility will exceed 100 tons per year; therefore, an ambient air quality analysis and preconstruction monitoring are required for ozone. A CAMx model was run and showed compliance with the ozone NAAQS.

### C. NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) ANALYSIS

Because the maximum modeled SO<sub>2</sub>, NO<sub>x</sub>, and PM<sub>10</sub> impact exceeded its PSD significance level, refined NAAQS modeling was required. Refined modeling demonstrates there are exceedances of the NAAQS in SO<sub>2</sub> and PM<sub>10</sub>. The facility proceeded to model their contribution to each exceedance at the date and time of the exceedance. In accordance with LAC 33:III.509.K, the facility has shown that they are below the significance level for each exceedance at the given time and location proving that this facility will not significantly cause or contribute to the exceedance of the NAAQS. The determination of significant contribution to an existing exceedance was performed in accordance with the July 5, 1988 memorandum, subject: "Air Quality Analysis for Prevention of Significant Deterioration", from Gerald A. Emison, Director, Office of Air Quality Planning and Standards to Thomas J. Maslany, Director, Air Management Division.

Pollutant	Time Period	Calculated Maximum Ground Level Concentration (Nucor plus Background)	Calculated Maximum Ground Level Concentration (Nucor Contribution)	National Ambient Air Quality Standard {NAAQS}
PM <sub>10</sub>	24 - hour	388.4 µg/m <sup>3</sup>	3.14 µg/m <sup>3</sup>	150 µg/m <sup>3</sup>
SO <sub>2</sub>	3 -hour	1693.2 µg/m <sup>3</sup>	14.4 µg/m <sup>3</sup>	1,300 µg/m <sup>3</sup>
SO <sub>2</sub>	24 - hour	630.8 µg/m <sup>3</sup>	4.72 µg/m <sup>3</sup>	365 µg/m <sup>3</sup>
SO <sub>2</sub>	Annual	88.5 µg/m <sup>3</sup>	0.18 µg/m <sup>3</sup>	80 µg/m <sup>3</sup>
NO <sub>x</sub>	Annual	60.2 µg/m <sup>3</sup>	-	100 µg/m <sup>3</sup>
CO*	1-hr	1194.4 µg/m <sup>3</sup>	-	40,000 µg/m <sup>3</sup>
CO*	8-hr	475.7 µg/m <sup>3</sup>	-	10,000 µg/m <sup>3</sup>

\*Preliminary Screening Concentration.

### D. PSD INCREMENT ANALYSIS

Because the maximum modeled PM<sub>10</sub> and SO<sub>2</sub> impacts for Class I modeling exceeded their PSD significance level, a determination of PSD increment consumption was required. Modeling demonstrates compliance with the allowable Class I and Class II PSD increment limit for PM<sub>10</sub> and SO<sub>2</sub>.

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Dispersion Model(s) Used: CALPUFF

Pollutant	Averaging Period	Class I PSD Increment	Modeled Class I Increment**	Class II PSD Increment	Modeled Class II Increment
PM <sub>10</sub>	24 - hour	8 µg/m <sup>3</sup>	0.23 µg/m <sup>3</sup>	30 µg/m <sup>3</sup>	24.8
SO <sub>2</sub>	3 -hour	25 µg/m <sup>3</sup>	#272.4 µg/m <sup>3</sup>	512 µg/m <sup>3</sup>	98.3
SO <sub>2</sub>	24 - hour	5 µg/m <sup>3</sup>	#88.8 µg/m <sup>3</sup>	91 µg/m <sup>3</sup>	37.9
SO <sub>2</sub>	Annual	2 µg/m <sup>3</sup>	0.010 µg/m <sup>3</sup>	20 µg/m <sup>3</sup>	9.1
NO <sub>x</sub>	Annual	2.5 µg/m <sup>3</sup>	0.0053 µg/m <sup>3</sup>	25 µg/m <sup>3</sup>	3.4

\*\* The PM<sub>10</sub>, SO<sub>2</sub> annual and the NO<sub>x</sub> annual preliminary screening values were below the PSD Increment Significance Levels

# Nucor's contribution to the SO<sub>2</sub> 24-hr and 3-hr increment is 0.013 µg/m<sup>3</sup> which is below the PSD Increment Significance Level demonstrating that Nucor will not significantly impact Class I increment.

### E. SOURCE RELATED GROWTH IMPACTS

Operation of this facility is expected to have some effect on residential growth and industrial/commercial development in the area of the facility. The surrounding area contains a higher than normal level of unemployment for the state. The resulting jobs will be able to employ many of the area residents. During Phase I, a peak of 2,000 construction workers will be directly employed in erecting the project facilities. During the construction of Phase II, an additional 1,250 construction jobs will be directly created by the project.

In addition to direct employment at the facility, local employment will be indirectly generated because of the project. Indirect employment results from businesses, contractors and suppliers that will be required to support the people and activities present during both construction and operation of the project. Examples of indirect jobs may be freight transportation of concrete and other construction materials, warehousing, professional services such as engineering and surveying, and infrastructure construction.

Additionally, the spending of direct, indirect and public monies generates additional employment in the local economy, a phenomenon often referred to as the multiplier effect. This employment, defined as induced employment, results from increased spending on:

- housing;
- food;
- clothing;
- leisure activities;

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- personal services, such as hairdressing and cleaning;
- business services, such as banking;
- transportation;
- utilities; and
- public services, such as education and healthcare.

The project is expected to generate almost 2,500 indirect and induced jobs in the region as a result of the two construction Phases. Indirect jobs will be related primarily to construction at the plant and induced jobs will be associated mostly in the wholesale and retail trade sector and the professional, scientific, and technical sector. As a result, there will not be any significant increases in pollutant emissions indirectly associated with Consolidated Environmental Management Inc's proposal. Secondary growth effects will include temporary construction related jobs and approximately 795 permanent jobs.

### **F. SOILS, VEGETATION, AND VISIBILITY IMPACTS**

Currently, the majority usage of the property is for sugar cane production, although a portion of the Entergy and Peabody properties are undeveloped except for pipeline and utility easements. The vast majority of wetland areas on the property will be undisturbed. However, some small impacts to wetlands on the property will be unavoidable. Small portions of existing wetland areas will need to be removed from the existing system for construction of the entrance road, site grading, building construction, and pile driving for the Mississippi River docks. Any wetlands removed from the property will be mitigated as required under the Section 404 of the Clean Water Act (CWA), as administered by the USACE.

The extreme northeastern corner of the proposed site is within 1,000 feet of the boundary of the Maurepas Swamp State Wildlife Management Area (WMA), which is considered a critical habitat. Given its distance away from the site, and the zero-discharge design of the facility, impacts to the Maurepas Swamp WMA due to project construction or operational activities are not expected.

Operational plans at Nucor Steel Louisiana do not include the production or storage of large quantities of chemicals at the site, and the risks of soil impacts are expected to be small during both the construction and operational phases of the facility. During operation, Nucor shall collect and use rain water to the maximum extent possible, mitigating the potential for erosion or sedimentation.

The construction team shall use dust suppression techniques (i.e., water spraying) on construction roadways and corridors if and whenever necessary to prevent or mitigate nuisance dust. There will be no significant impact on area soils, vegetation, or visibility.



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### **G. CLASS I AREA IMPACTS**

Louisiana's Breton Wildlife Refuge, the nearest Class I area, is over 100 kilometers from the site. The Federal Land Manager has designated criteria for determining the impact of industrial activities upon air quality-related values upon Class I areas, including visibility, and which facilities are subject to such review. Air dispersion modeling for receptor points at Breton was performed, using methods and protocols approved by the FLM. The air dispersion modeling does not indicate any significant impacts to visibility or visual amenity of Breton Island.

### **H. TOXIC EMISSIONS IMPACT**

The selection of control technology based on the BACT analysis included consideration of control of toxic emissions. In addition many of the emission sources are subject to either 40 CFR 63 Subpart L, CCCCC or FFFFF. Many of the BACT controls were more stringent than the NESHAPS.

### **V. CONCLUSION**

The Air Permits Division has made a preliminary determination to approve the construction of the facility at the Consolidated Environmental Management Inc - Nucor Steel Louisiana near Convent, St. James Parish, Louisiana, subject to the attached specific and general conditions. In the event of a discrepancy in the provisions found in the application and those in this Preliminary Determination Summary, the Preliminary Determination Summary shall prevail.

## SPECIFIC CONDITIONS

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- The permittee is authorized to operate in conformity with the specifications submitted to the Louisiana Department of Environmental Quality (LDEQ) as analyzed in LDEQ's document entitled "Preliminary Determination Summary" dated September 25, 2008 and subject to the following emissions limitations and other specified conditions. Specifications submitted are contained in the application and Emission Inventory Questionnaire dated May 12, 2008, along with supplemental information dated June 11, 2008 and July 16, 2008.

### MAXIMUM ALLOWABLE EMISSIONS RATES

Unit	ID No.	Description		PM <sub>10</sub>	SO <sub>2</sub>	NO <sub>x</sub>	CO	VOC
Blast Furnace / Hot Blast Stoves	RLP015	STV-101-Blast Furnace 1 Hot Blast Stoves Common Stack	lb/MM Btu BFG gr/dscf	0.002	0.039	0.06	0.0824	0.0054
	RLP016	STV-201-Blast Furnace 2 Hot Blast Stoves Common Stack	Nat. Gas gr/MMscf Specific Condition #		2500 # 2, # 3		# 4	# 4
Cast House	EQT015	CST-101- Cast House 1 Baghouse Vent	gr/dscf	0.003 <sup>1</sup>				
	EQT016	CST-201- Cast House 2 Baghouse Vent	lbs/ton hot metal	0.013	0.04		0.055	
Coke Oven Gas	RLP006	COK-111-Coke Battery 1 Flue Gas Desulfurization Stack	lbs/ton wet coal charged	0.01726		0.71	0.06	0.0035
	RLP012	COK-211-Coke Battery 2 Flue Gas Desulfurization Stack	Specific Condition #		# 2, # 3			
Blast Furnace and Coke Oven Coal Preparation	RLP013	PCI-101 - PCI Mill Vent	Specific Condition #	# 12				
	ARE001	COK-100 - Coke Ovens Coal Handling, Crushing, and Compacting						
	EQT004	COK-104 - Coke Battery 1 Coke Handling						
	EQT010	COK-204 - Coke Battery 2 Coke Handling						
Coke Oven Charging	EQT001	COK-101 - Coke Battery 1 Coal Charging	lbs/ton dry coal charged	0.0081 <sup>2</sup>				
	EQT007	COK-201 - Coke Battery 2 Coal Charging						
Coke Oven Pushing	EQT002	COK-102 - Coke Battery 1 Coal Pushing	lbs/ton coke pushed	0.04 <sup>3</sup>	0.098	0.019	0.0638	0.077
	EQT008	COK-202 - Coke Battery 2 Coal Pushing	Specific Condition #	# 5	# 5	# 5	# 5	# 5
Coke Quenching	EQT003	COK-103 - Coke Battery 1 Coke Quench Tower	Milligrams/liter TDS	≤1100 <sup>4</sup>				
	EQT009	COK-203 - Coke Battery 2 Coke Quench Tower						

<sup>1</sup>NESHAP Limit

<sup>2</sup> LDEQ has determined that compacted coal charging technology will meet the MACT emission limitation of 0.0081lb/ton of dry coal charged, required under 40 CFR 63.303(d)(2).

<sup>3</sup> LDEQ has determined that flat car pushing technology will meet the MACT emission limitation of 0.04 lb of filterable PM<sub>10</sub> per ton of coke pushed required under 40 CFR 63.7290.

<sup>4</sup> This technology will meet the MACT emission limitation of ≤ 1,100 milligrams per liter TDS concentration, required under 40 CFR 63.7295(a)(1)(i).

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Unit	ID No.	Description		PM <sub>10</sub>	SO <sub>2</sub>	NO <sub>x</sub>	CO	VOC
Slag Granulation & Slag Milling	EQT036	SLG-101 - Slag Granulator 1 Granulation Tank 1	Specific Condition #	# 6				
	EQT037	SLG-102 - Slag Granulator 1 Granulation Tank 2	Specific Condition #	# 6				
	EQT038	SLG-201 - Slag Granulator 2 Granulation Tank 1	Specific Condition #	# 6				
	EQT039	SLG-202 - Slag Granulator 2 Granulation Tank 2	Specific Condition #	# 6				
	EQT040	SLG-301 - Air-Cooled Slag Processing Load Bin	Specific Condition #	# 6				
	EQT041	SLG-302 - Air-Cooled Slag Processing Primary Crusher	Specific Condition #	# 6				
	EQT042	SLG-303 - Air-Cooled Slag Processing Primary Screening	Specific Condition #	# 6				
	EQT043	SLG-304 - Air-Cooled Slag Processing Secondary Crusher	Specific Condition #	# 6				
	EQT044	SLG-305 - Air-Cooled Slag Processing Secondary Screen	Specific Condition #	# 6				
	ARE011	SLG-306 - Air-Cooled Slag Processing Stockpiles	Specific Condition #	# 6				
	EQT045	SLG-401-Slag Mill Wet Slag Feed Bin	Specific Condition #	# 6				
	RLP014	SLG-402 - Slag Mill Dryer Stack	Specific Condition #	# 7				
	EQT046	SLG-403 - Slag Mill Dryer Baghouse Vent	Specific Condition #	# 7				
	EQT047	SLG-404 - Slag Mill Dry Slag Feed Bin Baghouse Vent	Specific Condition #	# 7				
	EQT048	SLG-405 - Slag Mill Crushers/Screeners Baghouse Vent	Specific Condition #	# 7				
	EQT049	SLG-406 - Slag Mill Building Baghouse Vent	Specific Condition #	# 7				
	EQT050	SLG-407 - Slag Mill Transfer Points Baghouse Vent	Specific Condition #	# 7				
	EQT051	SLG-408 - Slag Mill Product Silo Baghouse Vent	Specific Condition #	# 7				
	EQT052	SLG-409 - Slag Mill Loading Collector Baghouse Vent	Specific Condition #	# 7				
Blast Furnace Slag Pits	ARE005	SLG-104 - Blast Furnace 1 Slag Pit 1	Specific Condition #	# 8				
	ARE006	SLG-105 - Blast Furnace 1 Slag Pit 2						
	ARE007	SLG-106 - Blast Furnace 1 Slag Pit 3						
	ARE008	SLG-204 - Blast Furnace 2 Slag Pit 1						
	ARE009	SLG-205 - Blast Furnace 2 Slag Pit 2						
	ARE010	SLG-206 - Blast Furnace 2 Slag Pit 3						

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Unit	ID No.	Description		PM <sub>10</sub>	SO <sub>2</sub>	NO <sub>x</sub>	CO	VOC
Topgas Boilers	EQT023	PWR-101 - Topgas Boiler No. 1	gr/dscf	0.002				
	EQT024	PWR-102 - Topgas Boiler No. 2						
	EQT025	PWR-103 - Topgas Boiler No. 3	lb/MM Btu			0.092	0.0824	0.0054
	EQT026	PWR-104 - Topgas Boiler No. 4						
	EQT027	PWR-105 - Topgas Boiler No. 5						
	EQT028	PWR-106 - Topgas Boiler No. 6						
	EQT029	PWR-107 - Topgas Boiler No. 7						
	EQT030	PWR-108 - Topgas Boiler No. 8	Specific Condition #		# 2, # 3		# 4	# 4
Sinter Plant	EQT031	SIN-101 - MEROS System Vent Stack	lbs/ton finished sinter gr/dscf	0.3 <sup>5</sup> 0.002	0.437	0.495	17.942	0.1074
	EQT032	SIN-102 - Sinter Plant Main Dedusting Baghouse Vent	lbs/ton finished sinter gr/dscf gr/dscf	0.0036 0.005 0.01 <sup>6</sup>				
Cooling Towers	EQT060	TWR-101 - Blast Furnace Cooling Tower	milligrams/liter TDS	≤1100				
	EQT061	TWR-102 - Iron Solidification Cooling Tower						
	EQT062	TWR-103 - Air Separation Plant Cooling Tower	Specific Condition #	# 9				
Storage Piles	FUG001	PIL-101 - Coal Storage Piles						
	FUG002	PIL-102 - Iron Ore Pellet Storage Piles						
	FUG003	PIL-103 - Flux Storage Piles						
	FUG004	PIL-104 - Pig Iron Storage Piles						
	FUG005	PIL-105 - Granulated Slag Storage Piles						
	FUG006	PIL-106 - Sinter Storage Piles	Specific Condition #	# 10				
	FUG007	PIL-107 - Coke Breeze Storage Piles						
	FUG008	PIL-108 - Mill Scale Storage Piles						
Road Dust	ARE002	FUG-101 - Unpaved Road Fugitive Dust						
	ARE003	FUG-102 - Paved Road Fugitive Dust	Specific Condition #	# 11				
Hot Metal Handling	EQT021	PIG-101 - Pig Iron Desulfurization Station Baghouse Vent	lbs/ton hot metal processed	0.009				
	EQT022	PIG-102 - Pig Iron Solidification Baghouse Vent	lbs/ton hot metal processed	0.0019				
Stock House; Sinter Material Handling	EQT033	SIN-103 - Coke and Petcoke Crushing Dedusting Baghouse Vent						
	EQT034	SIN-105 - Sinter FGD Lime Silo Unloading						
	EQT035	SIN-106 - Sinter FGD Waste Loading						
	EQT053	STC-101 - Stock House 1 Baghouse Vent	Specific Condition #	# 12				
	EQT054	STC-201 - Stock House 2 Baghouse Vent						

<sup>5</sup> This emission rate is the MACT emission limitation of 0.3 lb/ton of product sinter, required under 40 CFR 63.7790(a).

<sup>6</sup> This is the MACT emission limitation for the discharge end and sinter cooler at a new sinter plant, required under 40 CFR 63.7790(a).

### SPECIFIC CONDITIONS

**Consolidated Environmental Management Inc - Nucor Steel Louisiana**

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**Consolidated Environmental Management Inc**

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Unit	ID No.	Description		PM <sub>10</sub>	SO <sub>2</sub>	NO <sub>x</sub>	CO	VOC
Material Handling and Transfer	EQT017	DOC-101 - Dock 1 Loading/Unloading Gantry Crane	Specific Condition #	# 13				
	EQT018	DOC-102 - Dock 2 Loading/Unloading Gantry Crane						
	EQT019	DOC-102 - Dock 2 Loading/Unloading Gantry Crane						
	EQT020	DST-101-Blast Furnace 1 Topgas Dust Catcher						
	ARE004	DST-201-Blast Furnace 2 Topgas Dust Catcher						
	EQT059	FUG-103 - Conveyor Fugitives						
		TRN-101 - Wagon Tipper						
Material Handling and Transfer	EQT005	COK-112 - Coke Battery 1 FGD Lime Silo Unloading	Specific Condition #	# 12				
	EQT006	COK-113 - Coke Battery 1 FGD Waste Loading						
	EQT011	COK-212 - Coke Battery 2 FGD Lime Silo Unloading						
	EQT012	COK-212 - Coke Battery 2 FGD Lime Silo Unloading						
	EQT013	COK-213 - Coke Battery 2 FGD Waste Loading						
	EQT014	COK-213 - Coke Battery 2 FGD Waste Loading						
		COK-214 - Coke Bin Tower						
		COK-215 - Coke Screening						

2. BACT is also selected as a maximum content of 1.3% sulfur in the coal.
3. BACT for SO<sub>2</sub> from natural gas combustion is to purchase natural gas containing no more than 2500 gr of Sulfur per MM scf for the Blast Furnace / Hot Blast Stoves/ Top Gas Boilers.
4. BACT for CO and VOC is selected to be good combustion practices during the operation of the Blast Furnace / Hot Blast Stoves/ Top Gas Boilers.
5. BACT is selected to be compacted coal and flat car pushing, which represents an Inherently Lower Polluting Process.
6. BACT is selected to be wet suppression of dust generating sources (slag granulation) by water sprays. This technology is inherent to the granulated slag process.
7. BACT for the granulated slag milling process is selected as collection and control by fabric filters.
8. BACT is determined to be wet suppression of dust generating sources by water sprays at the slag pits after air cooling and prior to removal by a mechanical loader.
9. BACT is selected to be a combination of less than 1,100 milligrams per liter TDS concentration in the cooling water and drift eliminators employing a drift maximum of 0.0005%.

## **SPECIFIC CONDITIONS**

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10. BACT is selected to be implementation of wet suppression of dust generating sources by water sprays at each storage pile site. Roadways shall be sprayed to reduce emissions.
11. BACT for road dust is selected as paving where practicable, and roadway watering and reduced speed limit on unpaved roads.
12. BACT is selected as collection and control by fabric filters.
13. BACT is selected to be enclosed conveyors as the most stringent control option for material handling conveyors. Water sprays and partial enclosures are additional control methods which will be employed at specific and drop points. BACT for the various loading and unloading operations and similar sources is selected as collection and control by fabric filters.

## LOUISIANA AIR EMISSION PERMIT GENERAL CONDITIONS

- I. This permit is issued on the basis of the emissions reported in the application for approval of emissions and in no way guarantees that the design scheme presented will be capable of controlling the emissions to the type and quantities stated. Failure to install, properly operate and/or maintain all proposed control measures and/or equipment as specified in the application and supplemental information shall be considered a violation of the permit and LAC 33:III.501. If the emissions are determined to be greater than those allowed by the permit (e.g. during the shakedown period for new or modified equipment) or if proposed control measures and/or equipment are not installed or do not perform according to design efficiency, an application to modify the permit must be submitted. All terms and conditions of this permit shall remain in effect unless and until revised by the permitting authority.
- II. The permittee is subject to all applicable provisions of the Louisiana Air Quality Regulations. Violation of the terms and conditions of the permit constitutes a violation of these regulations.
- III. The Emission Rates for Criteria Pollutants, Emission Rates for TAP/HAP & Other Pollutants, and Specific Requirements sections or, where included, Emission Inventory Questionnaire sheets establish the emission limitations and are a part of the permit. Any operating limitations are noted in the Specific Requirements or, where included, Tables 2 and 3 of the permit. The synopsis is based on the application and Emission Inventory Questionnaire dated May 12, 2008, along with supplemental information dated August 6, 2008, August 7, 2008, August 8, 2008, August 11, 2008, August 12, 2008, August 13, 2008, August 25, 2008, August 26, 2008 and September 24, 2008 were also received.
- IV. This permit shall become invalid, for the sources not constructed, if:
  - A. Construction is not commenced, or binding agreements or contractual obligations to undertake a program of construction of the project are not entered into, within two (2) years (18 months for PSD permits) after issuance of this permit, or;
  - B. If construction is discontinued for a period of two (2) years (18 months for PSD permits) or more:

The administrative authority may extend this time period upon a satisfactory showing that an extension is justified.

This provision does not apply to the time period between construction of the approved phases of a phased construction project. However, each phase must commence construction within two (2) years (18 months for PSD permits) of its projected and approved commencement date.
- V. The permittee shall submit semiannual reports of progress outlining the status of construction, noting any design changes, modifications or alterations in the construction schedule which have or may have an effect on the emission rates or ambient air quality levels. These reports shall continue to be submitted until such time as construction is certified as being complete. Furthermore, for any significant change in the design, prior approval shall be obtained from the Office of Environmental Services, Air Permits Division.
- VI. The permittee shall notify the Department of Environmental Quality, Office of Environmental Services, Air Permits Division within ten (10) calendar days from the date that construction is certified as complete and the estimated date of start-up of operation. The appropriate Regional

## LOUISIANA AIR EMISSION PERMIT GENERAL CONDITIONS

Office shall also be so notified within the same time frame.

- VII. Any emissions testing performed for purposes of demonstrating compliance with the limitations set forth in paragraph III shall be conducted in accordance with the methods described in the Specific Conditions and, where included, Tables 1, 2, 3, 4, and 5 of this permit. Any deviation from or modification of the methods used for testing shall have prior approval from the Office of Environmental Assessment, Air Quality Assessment Division.
  
- VIII. The emission testing described in paragraph VII above, or established in the specific conditions of this permit, shall be conducted within sixty (60) days after achieving normal production rate or after the end of the shakedown period, but in no event later than 180 days after initial start-up (or restart-up after modification). The Office of Environmental Assessment, Air Quality Assessment Division shall be notified at least (30) days prior to testing and shall be given the opportunity to conduct a pretest meeting and observe the emission testing. The test results shall be submitted to the Air Quality Assessment Division within sixty (60) days after the complete testing. As required by LAC 33:III.913, the permittee shall provide necessary sampling ports in stacks or ducts and such other safe and proper sampling and testing facilities for proper determination of the emission limits.
  
- IX. The permittee shall, within 180 days after start-up and shakedown of each project or unit, report to the Office of Environmental Compliance, Enforcement Division any significant difference in operating emission rates as compared to those limitations specified in paragraph III. This report shall also include, but not be limited to, malfunctions and upsets. A permit modification shall be submitted, if necessary, as required in Condition I.
  
- X. The permittee shall retain records of all information resulting from monitoring activities and information indicating operating parameters as specified in the specific conditions of this permit for a minimum of at least five (5) years.
  
- XI. If for any reason the permittee does not comply with, or will not be able to comply with, the emission limitations specified in this permit, the permittee shall provide the Office of Environmental Compliance, Enforcement Division with a written report as specified below.
  - A. A written report shall be submitted within 7 days of any emission in excess of permit requirements by an amount greater than the Reportable Quantity established for that pollutant in LAC 33:1.Chapter 39.
  - B. A written report shall be submitted within 7 days of the initial occurrence of any emission in excess of permit requirements, regardless of the amount, where such emission occurs over a period of seven days or longer.
  - C. A written report shall be submitted quarterly to address all emission limitation exceedances not included in paragraphs A or B above. The schedule for submittal of quarterly reports shall be no later than the dates specified below for any emission limitation exceedances occurring during the corresponding specified calendar quarter:
    - 1. Report by June 30 to cover January through March
    - 2. Report by September 30 to cover April through June
    - 3. Report by December 31 to cover July through September
    - 4. Report by March 31 to cover October through December



## LOUISIANA AIR EMISSION PERMIT GENERAL CONDITIONS

- D. Each report submitted in accordance with this condition shall contain the following information:
1. Description of noncomplying emission(s);
  2. Cause of noncompliance;
  3. Anticipated time the noncompliance is expected to continue, or if corrected, the duration of the period of noncompliance;
  4. Steps taken by the permittee to reduce and eliminate the noncomplying emissions; and
  5. Steps taken by the permittee to prevent recurrences of the noncomplying emissions.
- E. Any written report submitted in advance of the timeframes specified above, in accordance with an applicable regulation, may serve to meet the reporting requirements of this condition provided all information specified above is included. For Part 70 sources, reports submitted in accordance with Part 70 General Condition R shall serve to meet the requirements of this condition provided all specified information is included. Reporting under this condition does not relieve the permittee from the reporting requirements of any applicable regulation, including LAC 33.I.Chapter 39, LAC 33.III.Chapter 9, and LAC 33.III.5107.
- XII. Permittee shall allow the authorized officers and employees of the Department of Environmental Quality, at all reasonable times and upon presentation of identification, to:
- A. Enter upon the permittee's premises where regulated facilities are located, regulated activities are conducted or where records required under this permit are kept;
  - B. Have access to and copy any records that are required to be kept under the terms and conditions of this permit, the Louisiana Air Quality Regulations, or the Act;
  - C. Inspect any facilities, equipment (including monitoring methods and an operation and maintenance inspection), or operations regulated under this permit; and
  - D. Sample or monitor, for the purpose of assuring compliance with this permit or as otherwise authorized by the Act or regulations adopted thereunder, any substances or parameters at any location.
- XIII. If samples are taken under Section XII.D. above, the officer or employee obtaining such samples shall give the owner, operator or agent in charge a receipt describing the sample obtained. If requested prior to leaving the premises, a portion of each sample equal in volume or weight to the portion retained shall be given to the owner, operator or agent in charge. If an analysis is made of such samples, a copy of the analysis shall be furnished promptly to the owner, operator or agency in charge.
- XIV. The permittee shall allow authorized officers and employees of the Department of Environmental Quality, upon presentation of identification, to enter upon the permittee's premises to investigate potential or alleged violations of the Act or the rules and regulations adopted thereunder. In such investigations, the permittee shall be notified at the time entrance is requested of the nature of the suspected violation. Inspections under this subsection shall be limited to the aspects of alleged violations. However, this shall not in any way preclude prosecution of all violations found.

## LOUISIANA AIR EMISSION PERMIT GENERAL CONDITIONS

- XV. The permittee shall comply with the reporting requirements specified under LAC 33:III.919 as well as notification requirements specified under LAC 33:III.927.
- XVI. In the event of any change in ownership of the source described in this permit, the permittee and the succeeding owner shall notify the Office of Environmental Services in accordance with LAC 33:I.Chapter 19.Facility Name and Ownership/Operator Changes Process.
- XVII. Very small emissions to the air resulting from routine operations, that are predictable, expected, periodic, and quantifiable and that are submitted by the permitted facility and approved by the Air Permits Division are considered authorized discharges. Approved activities are noted in the General Condition XVII Activities List of this permit. To be approved as an authorized discharge, these very small releases must:
1. Generally be less than 5 TPY
  2. Be less than the minimum emission rate (MER)
  3. Be scheduled daily, weekly, monthly, etc., or
  4. Be necessary prior to plant startup or after shutdown [line or compressor pressuring/depressuring for example]

These releases are not included in the permit totals because they are small and will have an insignificant impact on air quality. This general condition does not authorize the maintenance of a nuisance, or a danger to public health and safety. The permitted facility must comply with all applicable requirements, including release reporting under LAC 33:I.3901.

- XVIII. Provisions of the permit may be appealed to the secretary in writing pursuant to La. R.S. 30:2024(A) within 30 days from notice of the permit action. A request may be made to the secretary to suspend those provisions of the permit specifically appealed. The permit remains in effect to the extent that the secretary or assistant secretary does not elect to suspend the appealed provisions as requested or, at his discretion, other permit provisions as well. Construction cannot proceed, except as specifically approved by the secretary or assistant secretary, until a final decision has been rendered on the appeal. A request for hearing must be sent to the Office of the Secretary. A request for hearing must be sent to the following:

Attention: Office of the Secretary, Legal Services Division  
La. Dept. of Environmental Quality  
Post Office Box 4302  
Baton Rouge, Louisiana 70821-4302

- XIX. For Part 70 sources, certain Part 70 general conditions may duplicate or conflict with state general conditions. To the extent that any Part 70 conditions conflict with state general conditions, then the Part 70 general conditions control. To the extent that any Part 70 general conditions duplicate any state general conditions, then such state and Part 70 provisions will be enforced as if there is only one condition rather than two conditions.

TABLE I: BACT COST SUMMARY

Consolidated Environmental Management Inc - Nucor Steel Louisiana

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NOTE: No alternatives were eliminated due to costs

Control Alternatives	Availability/ Feasibility	Negative Impacts (a)	Control Efficiency	Emissions Reduction (TPY)	Capital Cost (\$)	Annualized Cost (\$)	Cost Effectiveness (\$/ton)	Notes
<b>Source ID - Description (EQT #)</b>								
Pollutant	Description of Alternative Control #1							
	Description of Alternative Control #2							
Pollutant	Description of Alternative Control #1							
	Description of Alternative Control #2							
<b>Source ID - Description (EQT #)</b>								
Pollutant	Description of Alternative Control #1							
	Description of Alternative Control #2							
Pollutant	Description of Alternative Control #1							
	Description of Alternative Control #2							

Notes: a) Negative impacts: 1) economic, 2) environmental, 3) energy, 4) safety

TABLE II: AIR QUALITY ANALYSIS SUMMARY

## Consolidated Environmental Management Inc - Nucor Steel Louisiana

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Pollutant	Averaging Period	Preliminary Screening Concentration	Significant Monitoring Concentration	Current Monitored Background Concentration	Level of Significant Impact	Maximum Modeled Concentration	Modeled + Background Concentration	NAAQS	Modeled PSD Increment Consumption	Allowable Class II PSD Increment
PM <sub>10</sub>	24-hour	23.2	10	52	5	336.4	388.4	150	24.8	30
	3-hour	128.6	-	154.6	25	1538.6	1693.2	1300	98.3	512
	24-hour	38.9	13	49.8	5	581.0	630.8	365	37.9	91
SO <sub>2</sub>	Annual	8.8	-	10.5	1	78.7	88.5	80	9.1	20
	Annual	3.6	14	9.4	1	50.8	60.2	100	3.4	25
	Annual	3.6	14	9.4	1	50.8	60.2	100	3.4	25
NO <sub>x</sub>	Annual	3.6	14	9.4	1	50.8	60.2	100	3.4	25
CO	1-hour	1194.4	-	NA	2000	NA	NA	40,000	NA	-
	8-hour	475.7	575	NA	500	NA	NA	10,000	NA	-

NR = Not required